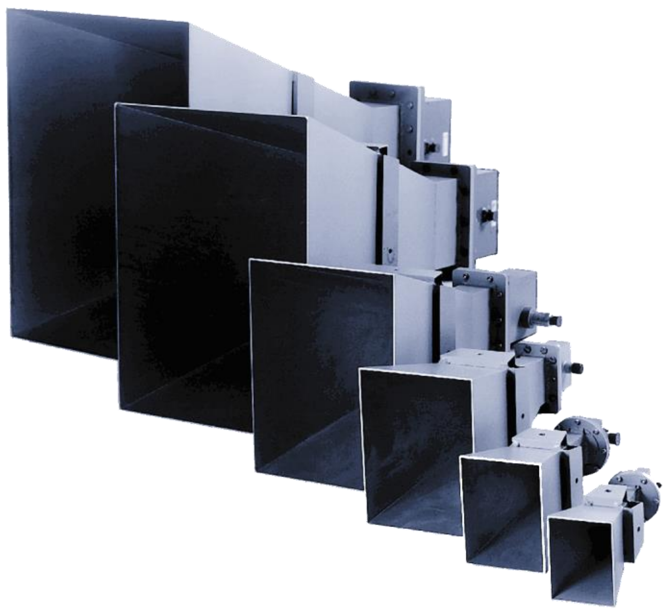
Model 3160 Series

Pyramidal Horn Antenna

User Manual



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An ESCO Technologies Company

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Revision Record | MANUAL, 3160 SERIES | Part #399185, Rev. F

Revision	Description	Date
A	Initial Release	February, 1992
B	Edits/updates	October, 2002
C	Edits/updates	July, 2003
D	Rebrand	July, 2010
E	Added 3160-u5 and 3160-u7 specifications	November, 2011
F	Added calculated gain formulas and data	July, 2014

Table of Contents

Notes, Cautions, and Warnings

→	**Note:** Denotes helpful information intended to provide tips for better use of the product.
CAUTION	**Caution**: Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.
WARNING	**Warning**: Denotes a hazard. Failure to follow instructions could result in SEVERE personal injury and/or property damage. Included text gives proper procedures.

→ See the ETS-Lindgren *Product Information Bulletin* for safety, regulatory, and other product marking information.

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1.0 Introduction

The **ETS-Lindgren Model 3160 Series Pyramidal Horn Antenna** is a series of pyramidal standard gain horn antennas designed specifically for utilization in emissions and immunity testing over the frequency range of 1 GHz to 40 GHz. The Model 3160 Series includes models 3160-01 through 3160-10.

Each Model 3160 Series antenna is linearly polarized and has medium gain, wide half-power beamwidth (HPBW) in both the horizontal and vertical planes, low VSWR over the recommended operating frequency range, and constant antenna factors so that the antennas can be used without looking up tables or charts.

The performance of the Model 3160 Series is precise and predictable through design parameters. Both input and output are well matched to 50 Ω and 377 Ω respectively. Comparisons of measured versus computed gain and antenna factors have been found to be within ±0.5dB. The Model 3160 Series antennas are considered to be the standard reference of measurements above 1 GHz, as is the resonant dipole for measurements below 1 GHz.

Each Model 3160 Series antenna is ruggedly constructed for good electromagnetic performance.

- Models 3160-01 through 3160-06 are welded using precise toolings and aluminum sheet metal.
- Models 3160-07 and 3160-08 are investment casted using an aluminum compound.
- Models 3160-09 and 3160-10 are electroformed using deposition of copper at a rate of 0.001 inch/hour for the highest precision available.
- Models 3160-01 through 3160-08 are conversion coated and painted for protection against corrosion and changes in the weather.

Each Model 3160 Series antenna comes completely assembled with a high performance, low VSWR, coax-to-waveguide adapter. Below 18 GHz, the transition from coax to waveguide is made using a female Precision N connector. Above 18 GHz, the transition uses female K connectors. The coax-to-waveguide adapters are the only power-limiting component, and can be removed if high fields are desired. For this purpose, the RF generator must be equipped with waveguide ports. In such a configuration, fields in excess of 10,000 V/m at 10 meters can be obtained.

Each Model 3160 Series antenna comes with a standard 1/4–20 mount. Horizontal and vertical polarizations are obtained by rotating the antennas from one position on the mount to the other. The mounts have been placed so as not to interfere with incoming electromagnetic energy. For the variety of mounting options available for the Model 3160 Series, see *Mounting Instructions* on page 20.

The Model 3160 Series may be used for either transmission or reception. The 50 ohm input impedance is well-matched for generating high electric fields with little power reflected back to the amplifier, reducing the chance of saturation. As a receiver, the antennas are matched to free space (377 ohms). Typical performance data is provided beginning on page 37. Methods for radiated emissions measurement are described on page 43.

For TEMPEST applications, all Model 3160 Series antennas, especially models 3160-03 and up, can be mounted on standard 12-, 18-, or 24-inch reflector dishes. The resulting antenna factor is usually about 20 dB lower than that of the antennas by themselves. However, the HPBW drops to less than 50 and the far field distance increases drastically making near field performance less predictable.

Tripod Options

CAUTION **Do not mount the Model 3160-01 or Model 3160-02 to a 4-TR.**

ETS-Lindgren offers the following non-metallic, non-reflective tripods for use at both indoor and outdoor EMC test sites.

- **4-TR Tripod—**Constructed of linen phenolic and delrin, designed with an adjustable center post for precise height adjustments. Maximum height is 2.0 m (80.0 in), and minimum height is 94 cm (37.0 in). This tripod can support up to an 11.8 kg (26.0 lb) load.



- **7-TR Tripod—**Constructed of PVC and fiberglass components, providing increased stability for physically large antennas. The unique design allows for quick assembly, disassembly, and convenient storage. Allows several different configurations, including options for manual or pneumatic polarization. Quick height adjustment and locking wheels provide ease of use during testing. Maximum height is 2.17 m (85.8 in), with a minimum height of 0.8 m (31.8 in). This tripod can support a 13.5 kg (30 lb) load.



ETS-Lindgren Product Information Bulletin

See the ETS-Lindgren *Product Information Bulletin* included with your shipment for the following:

- Warranty information
- Safety, regulatory, and other product marking information
- Steps to receive your shipment
- Steps to return a component for service
- ETS-Lindgren calibration service
- ETS-Lindgren contact information

2.0 Maintenance

CAUTION

Before performing any maintenance, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.



Maintenance of the Model 3160 Series is limited to external components such as cables or connectors.

If you have any questions concerning maintenance, contact ETS-Lindgren Customer Service.

- When not in use, the Model 3160 Series Pyramidal Horn Antenna should be stored on a shelf face down to keep dust out of the feed areas.
- If the Model 3160 Series is used outdoors, the antennas should be checked for water accumulations. Water has a high dielectric constant and can alter performance.
- If an antenna is dropped, the feed/horn joint should be checked for misalignment.

Annual Calibration

The electromagnetic performance of the Model 3160 Series is almost exclusively dependent on the physical dimensions of the horns. Comparisons with computed gain and antenna factor result in differences within 1 dB. Therefore, it is not necessary to calibrate Model 3160 Series antennas; only a mechanical check is required to guarantee performance. However, if calibration is required, see the *Product Information Bulletin* included with your shipment for information on ETS-Lindgren calibration services.

Service Procedures

For the steps to return a system or system component to ETS-Lindgren for service, see the *Product Information Bulletin* included with your shipment.

3.0 Specifications

Electrical Specifications

MODEL 3160 SERIES

- The VSWR indicated in the following table is that of the pyramidal horn antenna and coax-to-waveguide adapter. The VSWR of the antenna by itself is of the order of 1.1:1.
- The maximum continuous power indicated in the following table is mainly limited by the coax-to-waveguide adapter. The antenna itself is capable of handling continuous power on the order of 10^4 Watts to 10^7 Watts.

Model	Frequency GHz		AF dB(1/m)	VSWR w/ feed	Max. Cont. Power, W	Connector Type
3160-01	0.96	1.40	15.40	1.6	550	Prec. N
3160-02	1.12	1.70	16.85	1.5	500	Prec. N
3160-03	1.70	2.60	20.60	1.5	250	Prec. N
3160-04	2.60	3.95	23.80	1.5	200	Prec. N
3160-05	3.95	5.85	27.30	1.5	200	Prec. N
3160-06	5.85	8.20	29.90	1.5	200	Prec. N
3160-07	8.20	12.40	33.50	1.5	200	Prec. N
3160-08	12.40	18.00	37.15	1.5	200	Prec. N
3160-09	18.00	26.50	40.30	1.5	50	K
3160-10	26.50	40.00	43.55	1.5	10	K

MODEL 3160-U5 AND MODEL 3160-U7: STANDARD GAIN HORNS BELOW 1 GHZ

ETS-Lindgren also offers these two standard gain horns:

- **Model 3160-u5—**Operates from 500 MHz to 750 MHz.
- **Model 3160-u7—**Operates from 750 MHz to 1 GHz.

These horns require customized mounts due to their large physical size; for more information see the Model 3160-u5 and Model 3160-u7 drawings provided in *Physical Specifications* beginning on page 20.

The following sections provide the computed gain for the Model 3160-u5 and Model 3160-u7.

→ Far field gain computed using full wave analysis MW Studio.

Frequency (MHz)	Computed Gain (dBi)	Numeric Gain	VSWR
500	16.42	43.87	1.48
510	16.76	47.37	1.43
520	16.95	49.52	1.35
530	17.02	50.40	1.24
540	17.06	50.80	1.13
550	17.11	51.44	1.07
560	17.21	52.56	1.12
570	17.32	53.93	1.17
580	17.42	55.19	1.17
590	17.50	56.25	1.13
600	17.58	57.30	1.07
610	17.68	58.55	1.06
620	17.78	60.01	1.13
630	17.88	61.44	1.18
640	17.96	62.55	1.18
650	18.02	63.37	1.16
670	18.18	65.80	1.10
680	18.33	68.09	1.08

Frequency (MHz)	Computed Gain (dBi)	Numeric Gain	VSWR
690	18.50	70.79	1.09
700	18.64	73.11	1.13
710	18.71	74.30	1.16
720	18.70	74.13	1.16
760	18.65	73.22	1.14
740	18.53	71.30	1.12
750	18.50	70.86	1.10

MODEL 3160-U7

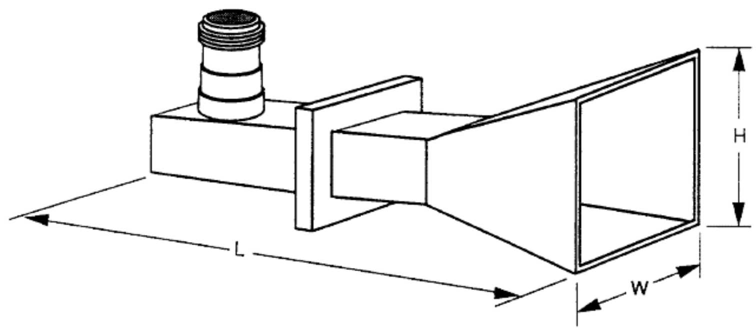
Far field gain computed using full wave analysis MW Studio.

Frequency (MHz)	Computed Gain (dBi)	Numeric Gain	VSWR
750	14.64	29.09	1.35
760	14.77	29.99	1.33
770	14.90	30.91	1.34
780	15.03	31.84	1.38
790	15.15	32.77	1.41
800	15.26	33.60	1.42
810	15.35	34.27	1.38
820	15.41	34.77	1.31
830	15.46	35.17	1.21

Frequency (MHz)	Computed Gain (dBi)	Numeric Gain	VSWR
840	15.51	35.57	1.11
850	15.57	36.07	1.07
860	15.64	36.67	1.11
870	15.73	37.39	1.16
890	15.93	39.14	1.19
900	16.04	40.15	1.18
910	16.15	41.24	1.16
920	16.27	42.35	1.12
930	16.38	43.45	1.09
940	16.49	44.53	1.08
950	16.59	45.56	1.11
960	16.68	46.51	1.16
970	16.76	47.37	1.22
980	16.82	48.12	1.26
990	16.88	48.76	1.28
1000	16.93	49.37	1.27

Physical Specifications

MODEL 3160 SERIES



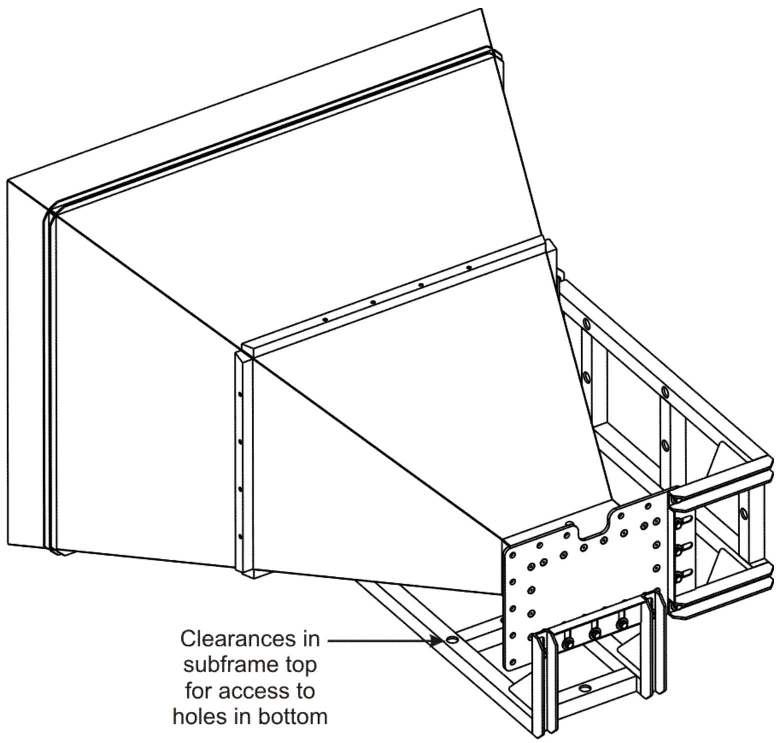
Model	Height H, cm	Width W, cm	Length L, cm	Weight kg	Construction
3160-01	62.6	46.9	103.2	25.000	Welded
3160-02	52.8	39.6	88.3	10.000	Welded
3160-03	34.0	26.0	62.2	4.545	Welded
3160-04	23.5	17.5	53.3	2.273	Welded
3160-05	15.7	11.6	36.2	1.620	Welded
3160-06	11.6	8.6	30.5	0.795	Welded
3160-07	7.6	5.8	22.9	0.426	Invest. Cast
3160-08	5.1	3.8	15.9	0.284	Invest. Cast
3160-09	3.5	2.7	10.5	0.114	Electro-formed
3160-10	2.5	1.8	9.5	0.057	Electro-formed

MODEL 3160-U5 AND MODEL 3160-U7: STANDARD GAIN HORNS BELOW 1 GHZ

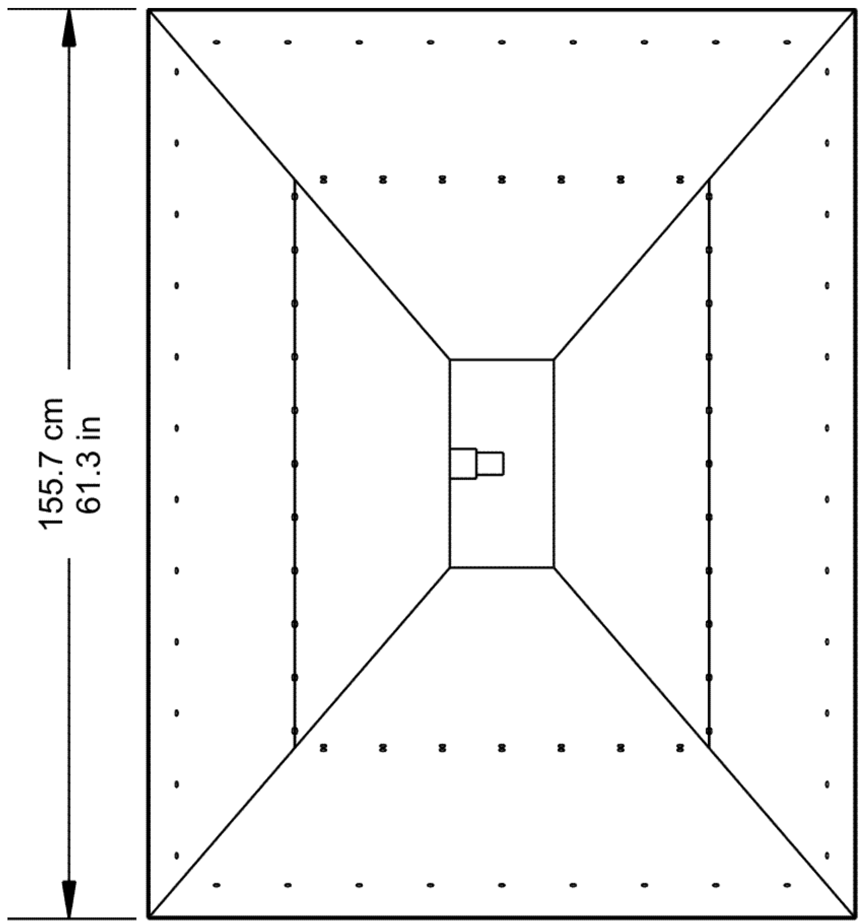
MODEL 3160-U5

Weight (approximate):	95.3 kg (210.0 lb)

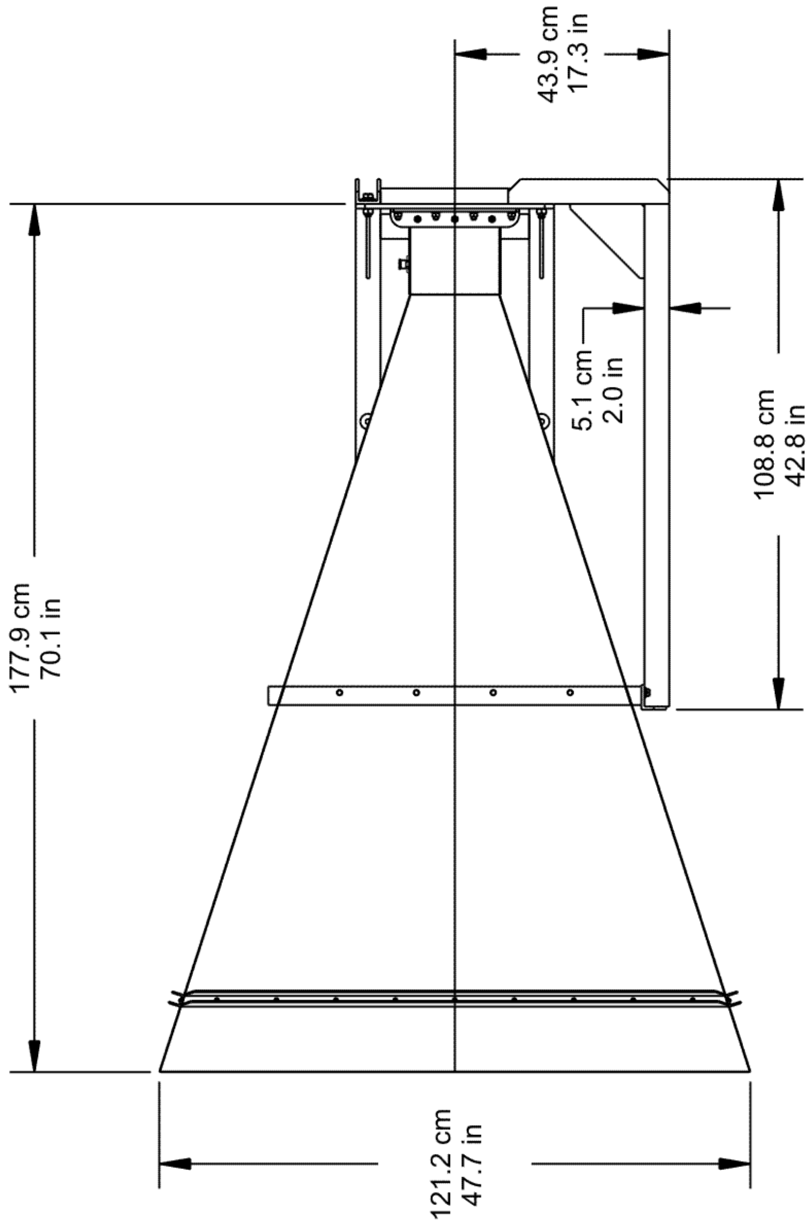
Two mounting subframes with hardware are provided with the Model 3160-u5. Hardware for customer mount is not provided.



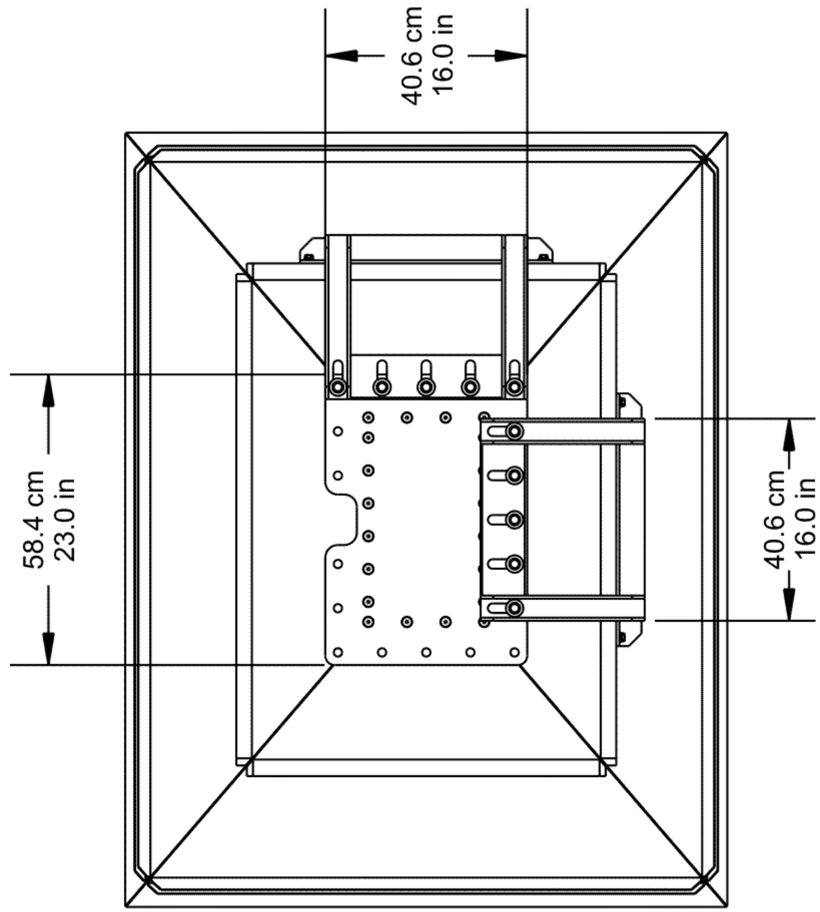
Model 3160-u5 Aperture View



Model 3160-u5 Side View

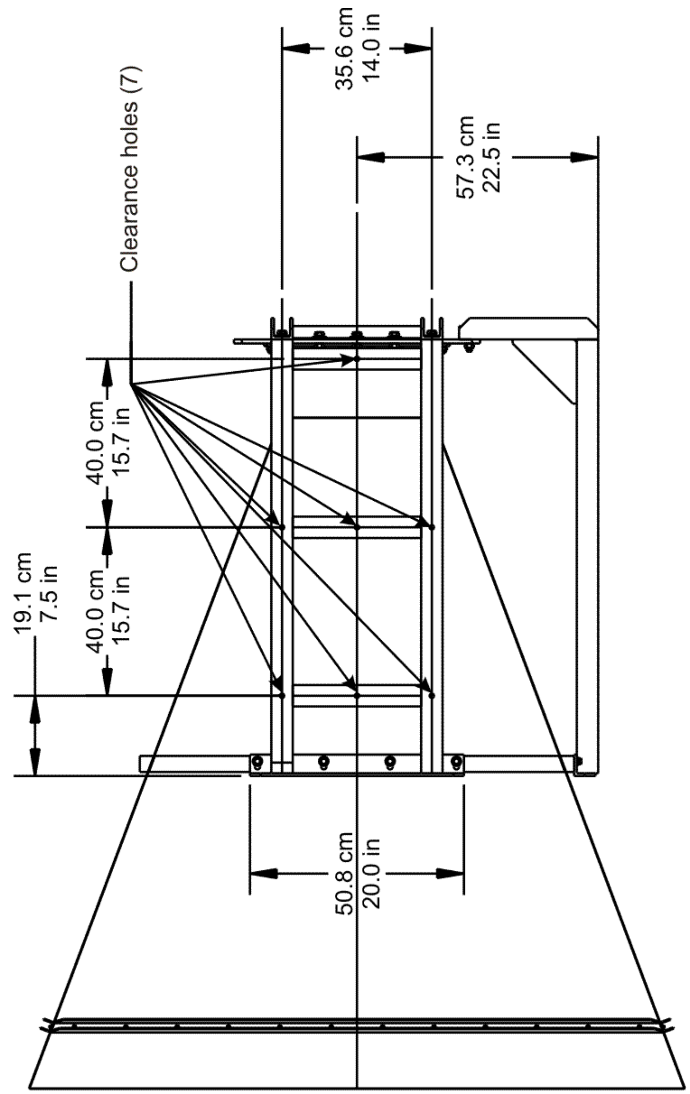


Model 3160-u5 Back View



Model 3160-u5 Bottom View

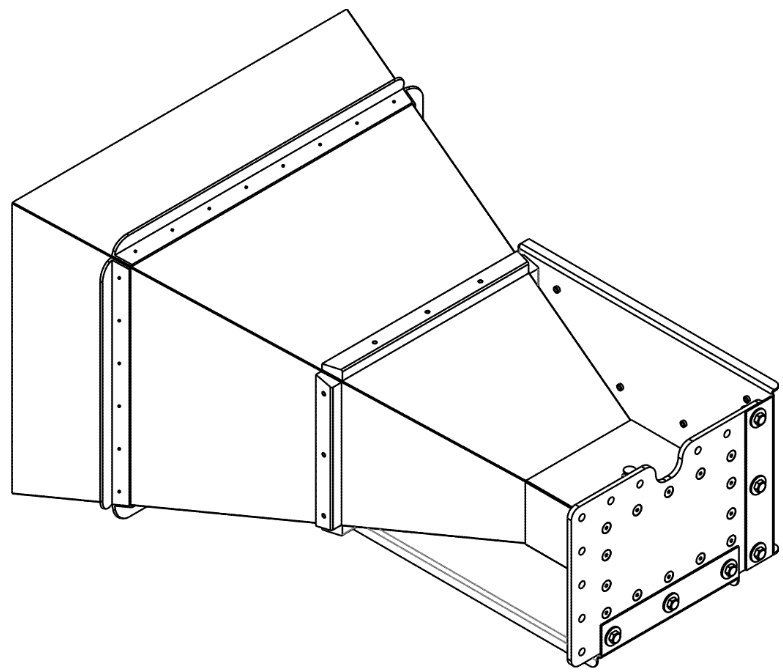
Clearance holes (7) in bottom of subframe are for M8 or 3/8–16 bolts. Hardware not provided.



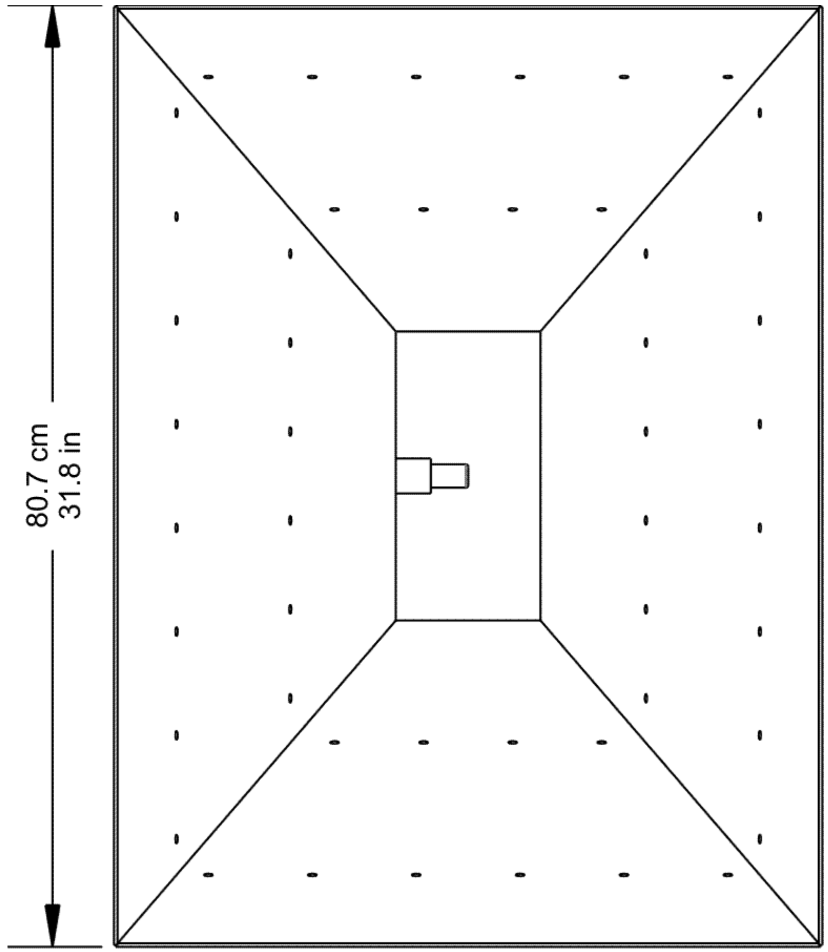
MODEL 3160-U7

Weight (approximate):	32.7 kg (72.0 lb)

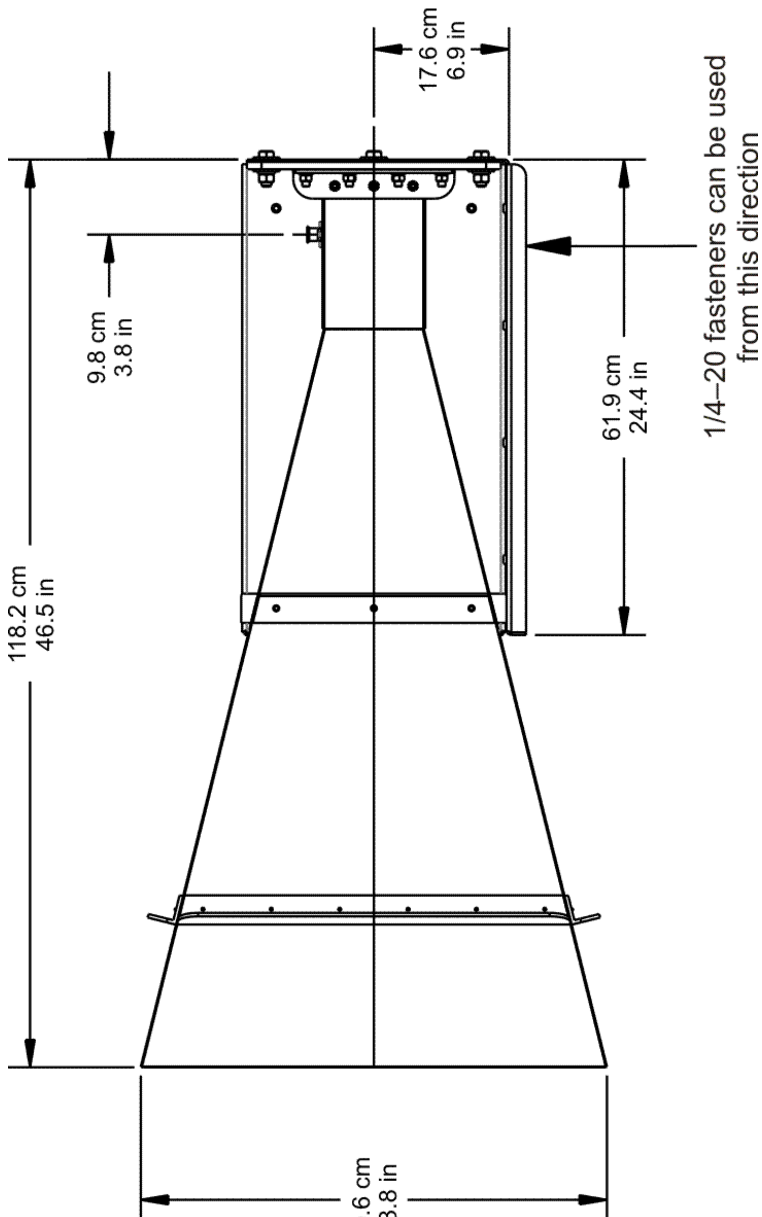
Two mounting platforms are provided with the Model 3160-u7. Mounting fasteners (1/4–20) are not provided.



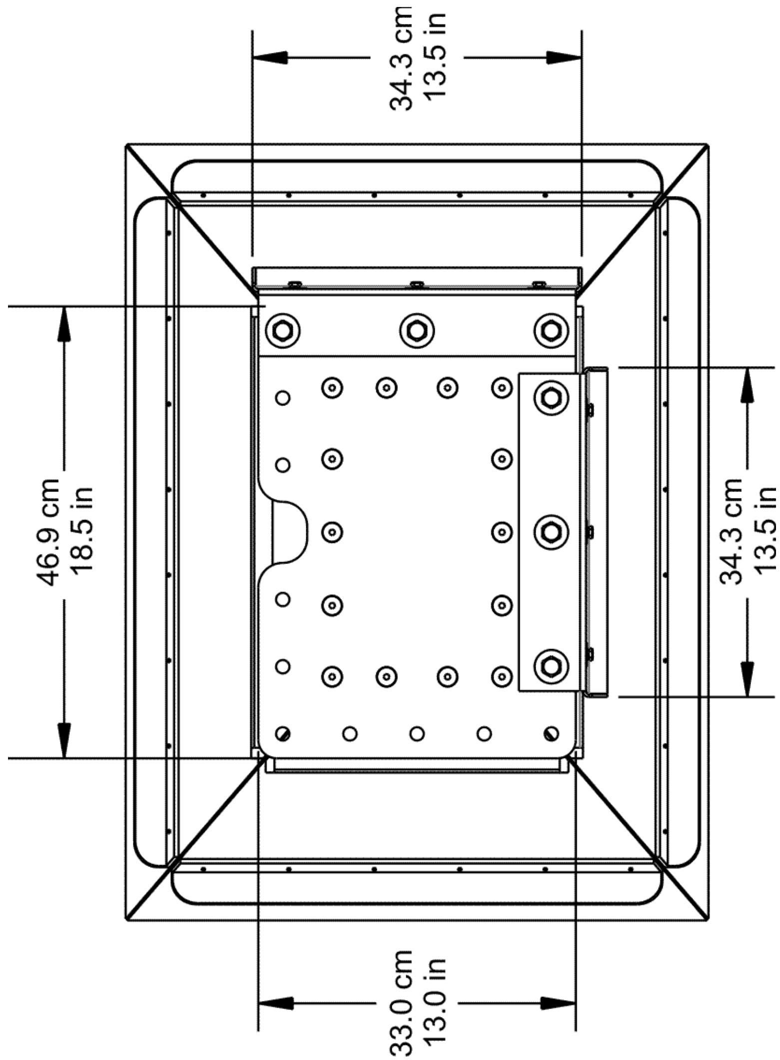
Model 3160-u7 Aperture View



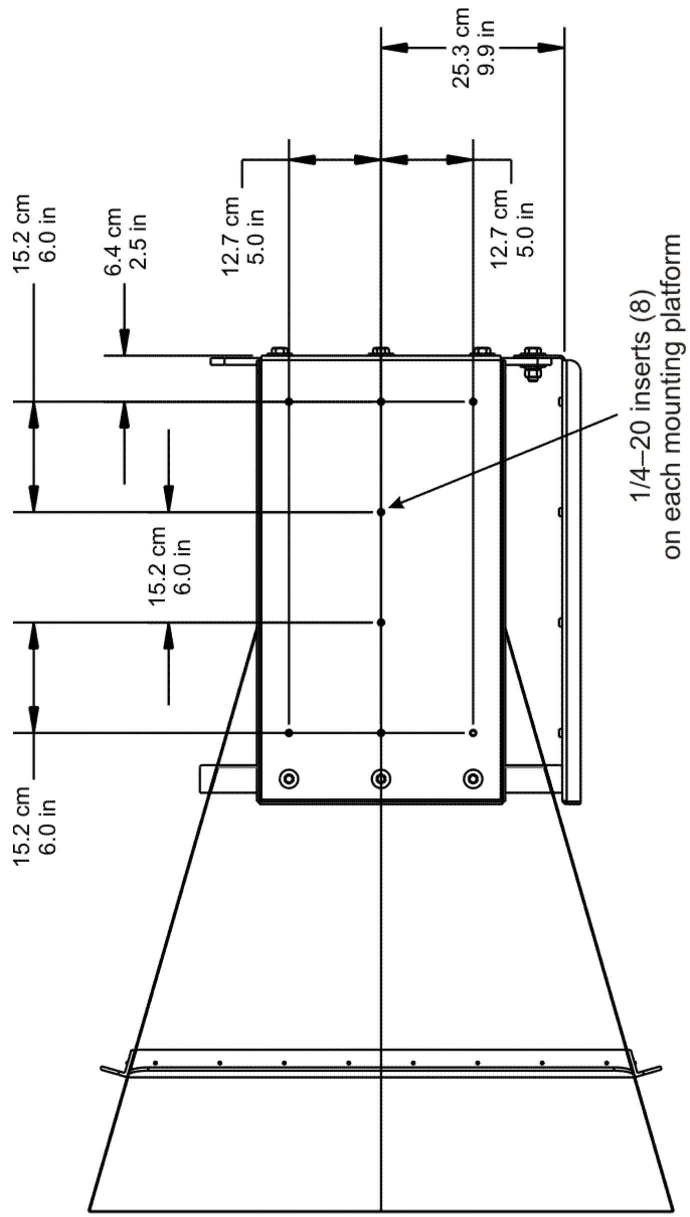
Model 3160-u7 Side View



Model 3160-u7 Back View



Model 3160-u7 Bottom View



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4.0 Mounting Instructions

CAUTION

Before connecting any components, follow the safety information in the ETS-Lindgren Product Information Bulletin included with your shipment.

CAUTION

The Model 3160 Series antennas are precision measurement devices. Handle your antenna with care.

➔ Horizontal and vertical polarizations can be achieved by rotating the antenna from one mount to the other.

➔ The Model 3160-u5 and Model 3160-u7 horns require customized mounts due to their large physical size; for more information see the Model 3160-u5 and Model 3160-u7 drawings provided in *Physical Specifications* beginning on page 20.

The Model 3160 Series Pyramidal Horn Antenna is equipped with a standard 1/4–20 mount. The mount is placed so as not to interfere with incoming electromagnetic energy.

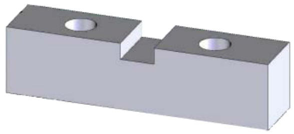
Once mounted, remove the red cover from the Type N connector and attach a cable between the antenna and a transmitting/receiving RF device. Rotate the antenna for horizontal and vertical polarizations as needed.

3160-09 and 3160-10 Only

The 3160-09 and 3160-10 antennas ship with a supplemental mount that may be used with the 4-TR Tripod, 7-TR Tripod, mast, and 2x2 boom.

3160-09

- 103255 Clamping Block

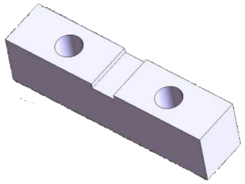


- 103256 Mounting Bracket

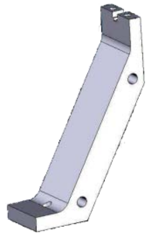


3160-10

- 103253 Clamping Block



- 103254 Mounting Bracket



Mount to 4-TR

CAUTION

Do not mount the Model 3160-01 or Model 3160-02 to a 4-TR.

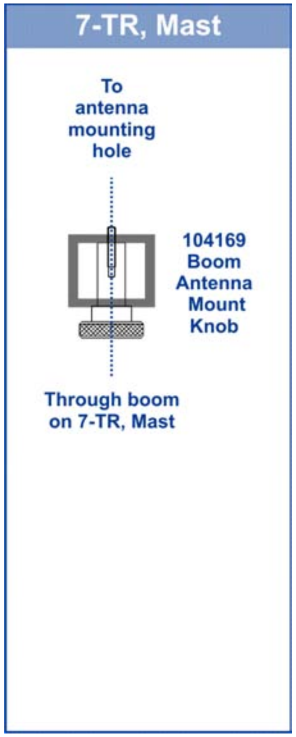
Model 3160 Series antennas mount directly to an ETS-Lindgren 4-TR Tripod; no additional hardware is required. Secure the mount onto the 4-TR by tightening the1/4–20 UNC mount knob.

Mount to 7-TR and Mast

Following is an option for mounting the Model 3160 Series onto an ETS-Lindgren 7-TR Tripod or mast. Contact the ETS-Lindgren Sales Department for information on ordering optional mounting hardware.

Mast refers to 2070 Series, 2075, and 2175 Antenna Towers.
7-TR refers to these booms:

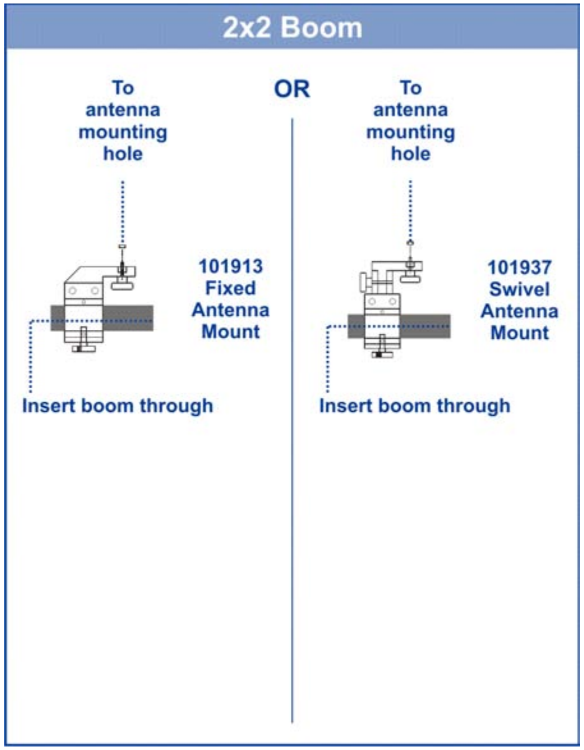
- *109042 boom*— Straight boom; for general antenna mounting on a 7-TR
- *108983 boom*— Offset boom; for general antenna mounting on a 7-TR with pneumatic or manual polarization; can also be used to mount stinger-type antennas
- *108507 boom*—Centerline rotation boom for Model 3106 Series antennas only; when changing polarization, maintains centerline rotation



Mount to 2x2 Boom

Following are options for mounting the Model 3160 Series onto a 2x2 boom. Contact the ETS-Lindgren Sales Department for information on ordering optional mounting hardware.

2x2 boom refers to a typical 2-inch by 2-inch boom.



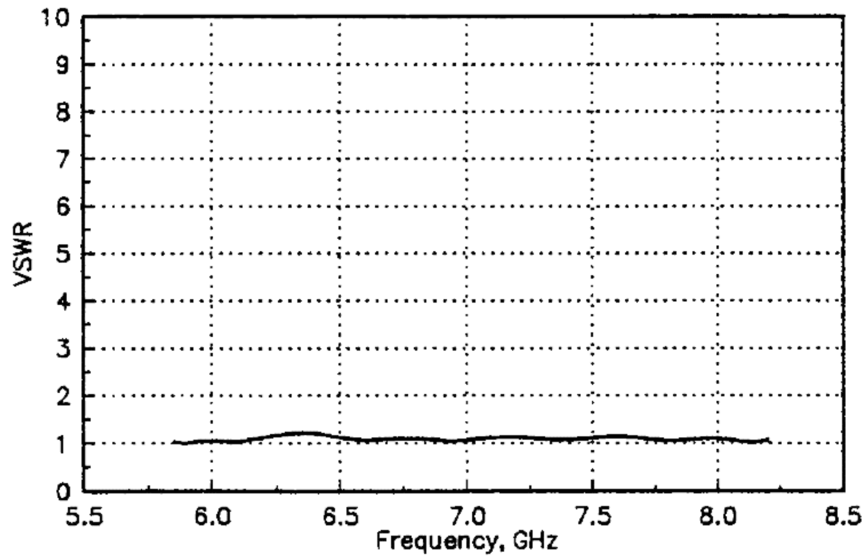
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5.0 Typical Data

Following is typical electromagnetic performance data for the Model 3160 Series Pyramidal Horn Antenna, using Model 3160-06 data as representative of the series. See *Model 3160 Series Data* on page 61 for data for all Model 3160 Series antennas.

Typical VSWR (3160-06)

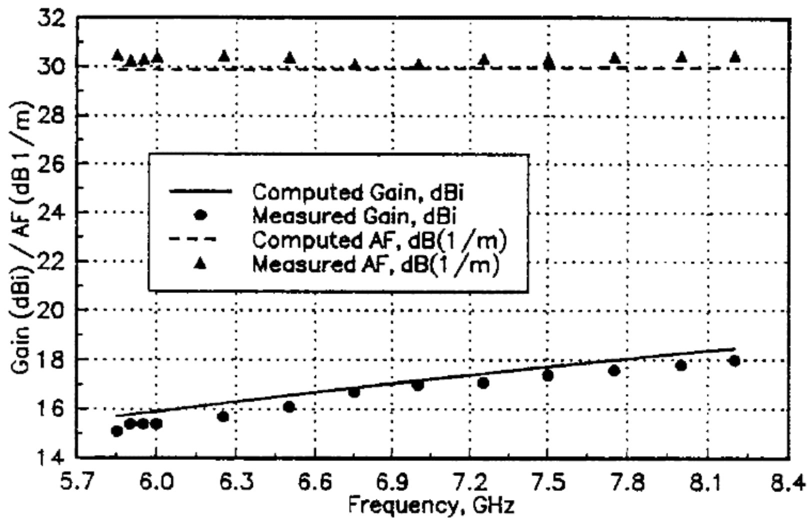
The following shows the antenna/coax-to-waveguide adapter assembly.



Typical Gain and Antenna Factor (3160-06)

Following is a plot of computed and measured gain and antenna factor versus frequency. The measured and computed results are within 3 dB, which is typical of pyramidal horns. Differences are attributed to imperfections in the measurements setup. The left vertical scale is for the gain measured in dBi, and the right vertical scale is for the antenna factor in dB(m^{-1}). The antenna factor spans only 0.6 dB from minimum to maximum; therefore, it may be considered constant over the entire frequency band without loss of accuracy. The gain is computed from the antenna factor using:

$$G(dB) = 20 \log (f_{GHz}) - AF_{dB(m^{-1})} + 30.22$$



Calculated Far Field Gain

The gain of a pyramidal horn (linear gain, not dB) is calculated as follows:

$$g = \frac{8\pi l_E l_H}{AB}[C^2(w) + S^2(w)] \cdot [(C(u) - C(v))^2 + (S(u) - S(v))^2]$$

Where

$$u = \frac{1}{\sqrt{2}}\left(\frac{\sqrt{\lambda l_H}}{A} + \frac{A}{\sqrt{\lambda l_H}}\right)$$

And

$$v = \frac{1}{\sqrt{2}}\left(\frac{\sqrt{\lambda l_H}}{A} - \frac{A}{\sqrt{\lambda l_H}}\right)$$

Finally

$$w = \frac{B}{\sqrt{2\lambda l_E}}$$

And C(x) and S(x) are the Fresnel Cosine Integral and the Fresnel Sine Integral functions.

Geometry of the Horns

units in cm or degrees			aperture		waveguide		flare	Flares E and H	
	angle H	angle E	A	B	a	b	L	ℓ_E	ℓ_H
3160-u5	41	36	155.42	120.88	35.56	17.78	159.16	253.11	171.98
3160-u7	32	28	80.41	59.99	25.07	12.38	96.14	167.07	108.31
3160-01	32	28	62.58	49.87	19.56	9.78	75.00	130.35	90.44
3160-02	32	27	52.82	39.55	16.51	8.26	64.00	111.20	72.46
3160-03	31	28	34.00	26.00	10.92	5.46	41.52	70.93	48.64
3160-04	23	20	23.50	17.50	7.21	3.40	40.00	67.71	43.86
3160-05	23	20	16.01	11.60	5.07	2.52	26.85	46.70	29.00
3160-06	23	20	11.59	8.59	3.49	1.58	20.00	34.18	21.92
3160-07	24	22	7.60	5.80	2.29	1.02	12.62	20.37	14.06
3160-08	29	24	5.01	3.73	1.50	0.71	7.02	11.91	7.51
3160-09	30	26	3.54	2.56	0.95	0.32	4.69	7.96	5.00
3160-10	31	26	2.46	1.77	0.60	0.24	3.13	5.51	3.27

Calculated Gain

3160-u5		3160-u7		3160-01		3160-02	
Frequency	G	Frequency	G	Frequency	G	Frequency	G
0.5	16.42	0.75	14.5549	0.96	14.8231	1.12	14.4253
0.55	17.07	0.8	15.0711	1.06	15.6164	1.236	15.2158
0.6	17.64	0.85	15.5505	1.16	16.3255	1.352	15.9232
0.65	18.13	0.9	15.997	1.26	16.9633	1.468	16.5601
0.7	18.16	0.95	16.4139	1.36	17.5397	1.584	17.1364
0.75	18.92	1	16.8039	1.46	18.0626	1.7	17.6598

3160-03		3160-04		3160-05		3160-06	
Frequency	G	Frequency	G	Frequency	G	Frequency	G
1.7	14.34	2.6	14.811	3.95	14.9746	5.85	15.6617
1.88	15.1526	2.87	15.6315	4.33	15.7343	6.32	16.2986
2.06	15.8791	3.14	16.371	4.71	16.4232	6.79	16.8847
2.24	16.5331	3.41	17.0425	5.09	17.09	7.26	17.4266
2.42	17.1247	3.68	17.6558	5.47	17.6294	7.73	17.9293
2.6	17.6622	3.95	18.2182	5.85	18.161	8.2	18.3973

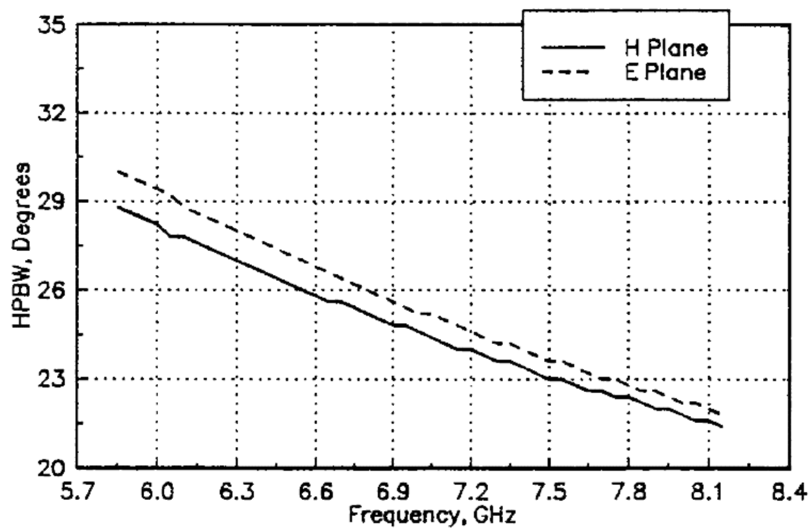
3160-07		3160-08		3160-09		3160-10	
Frequency	G	Frequency	G	Frequency	G	Frequency	G
8.2	15.0692	12.4	14.8536	18	14.9048	26.5	15.0323
9.04	15.8748	13.52	15.5532	19.7	15.9601	29.2	15.7974
9.88	16.6011	14.64	16.1886	21.4	16.2776	31.9	16.4806
10.72	17.2604	15.76	16.7687	23.1	16.8683	34.6	17.0941
11.56	17.8623	16.88	17.3006	24.8	17.4065	37.3	17.6474
12.4	18.4142	18	17.7898	26.5	17.8984	40	18.148

Typical Half-Power Beamwidth (3160-06)

Following is a plot of the half-power beamwidth (HPBW) versus frequency. The information provides the size of the Equipment Under Test (EUT) that can be illuminated without scanning. The size of the EUT can be obtained as:

$$EUT = 2\left[\text{Distance} \cdot \tan\left(\frac{HPBW}{2}\right)\right]$$

Distance is the distance between the EUT and the aperture of the antenna



6.0 Radiated Emissions Measurements

Measure Ambient Field Strength Values

1. Install the antenna where measured field strength values are desired.
2. Adjust the desired orientation of the antenna for both bore site direction and polarization.
3. Connect the output connector of the antenna to the input of the receiving system using a low VSWR, low loss coaxial cable. The Model 3160 Series Pyramidal Horn Antennas are designed for receiving systems having 50 Ω input impedance. Other values of receiving system input impedance will require correction for the difference in impedance mismatch.
4. Set desired measurement frequency on the receiving system. Make sure that the selected frequency is one that can be used with the antenna that is connected to the system.
5. Measure the RF voltage, V_a, referenced to the input port of the receiving system. The units of the measurement should be in decibels referenced to 1 microvolt, dB(μV). If the units of measurements are millivolts, they should be converted to dB(μV) by:

$$V_a = 20\ \log_{10}(\text{RF voltage in microvolts})$$

$$V_a = 20\ \log_{10} V_d$$

6. Determine the field strength at the frequency of observation by adding the voltage reading on the receiving system in dB(μV) to the antenna factor in dB(m^{-1}):

$$\text{RF Voltage, dB}(\mu\text{V}) + \text{Antenna Factor, dB}(\text{m}^{-1}) =$$

$$\text{Field Strength, dB}(\mu\text{V/m})$$

$$E_a = V_a + AF$$

The losses of the coaxial cable, A_c , should be included in the computations. In this case, the previous equation becomes:

$$\text{RF Voltage, dB}(\mu\text{V}) + \text{Cable Loss, dB} + \text{Antenna Factor, DB}(\text{m}^{-1}) = \text{Field Strength, dB}(\mu\text{V/m})$$

$$E_a = V_a + A_c + AF$$

Conversion Formulas

Following are some useful conversion formulas, including how the constants are obtained:

EQUATION 1

$$\text{dBm}=\text{dB}(\mu\text{V})-107$$

The power is related to the voltage and the system impedance as:

$$P = \frac{V^2}{R}$$

In a 50 Ω system, the previous equation becomes:

$$10\log_{10} P = 20\log_{10} V - 10\log_{10}(50)$$

Converting from dB to dBm for power and from dB(V) to dB(µV) for voltage, the overall constant becomes:

$$30 - 120 - 10\log_{10}(50) = -107$$

EQUATION 2

$$dB(mW/m^2) = dB(\mu V/m) - 115.8$$

The constant in this equation is obtained by considering the Poynting vector which relates the power density in (W/m^2) to the electric field strength in (V/m) by:

$$P = \frac{|E|^2}{\eta}$$

Where η is the free space characteristic impedance equal to 120π Ω. Transforming the previous questions to decibels and using the appropriate conversion factors to convert dB(W/m^2) to dB(mW/m^2) for power density and dB(V/m) to dB(μV/m) for the electric field, the constant becomes:

$$30 - 120 - 10\log_{10}(120\pi) = -115.8$$

EQUATION 3

$$dB(\mu V/m) = dB(\mu V) + AF$$

EQUATION 4

$$V/m = 10^{\frac{dB(\mu V/m) - 120}{20}}$$

EQUATION 5

$$dB(\mu A/m) = dB(\mu V/m) - 51.5$$

The magnetic field strength is related to the electric field strength via the characteristic impedance of free space. When the transformation is made to decibels, the constant becomes:

$$20\log_{10}(120\pi)=51.5$$

EQUATION 6

$$\text{A/m} = 10^{\frac{\text{dB}(\mu\text{A/m})-120}{20}}$$

EQUATION 7

$$\text{dB(W/m}^2) = 10\log(\text{V/m} \cdot \text{A/m})$$

EQUATION 8

$$\text{dB(mW/m}^2) = \text{dB(W/m}^2) + 30.0$$

EQUATION 9

$$\text{dB(pT)} = \text{dB}(\mu\text{A/m}) + 2.0$$

The magnetic flux density **B** in (T) is related to the magnetic field strength **H** in (A/m) by the permeability of the medium in (H/m). For free space, the permeability is $\mu_o = 4\pi.10^{-7}$ H/m. Converting from (T) to (pT) and from (A/m) to (μA/m) and taking the log, the constant becomes:

$$240-120+20\log_{10}(4\pi\times10^{-7})=2.0$$

Appendix A: Warranty

See the *Product Information Bulletin* included with your shipment for the complete ETS-Lindgren warranty for your Model 3160 Series.

Duration of Warranties for Model 3160 Series

All product warranties, except the warranty of title, and all remedies for warranty failures are limited to two years.

Product Warranted	**Duration of Warranty Period**
Model 3160 Series Pyramidal Horn Antenna	2 Years

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Appendix B: Power Requirements

The Model 3160 Series Pyramidal Horn Antenna is an efficient transmitting antenna, capable of generating high electric field strengths using little power. For a given electric field strength, the required power can be computed using the transmission equation:

$$\text{Power Transmitted} = \frac{(\text{Field Strength})^2 \, (\text{Distance in meters})^2}{(30 \times \text{Numeric Gain})}$$

$$P_t = \frac{|E|^2 \, R^2}{30\,g}$$

The typical power requirements in Watts for the 3161-06 are shown in Table 11 Table 12 on page 56. Distance is measured from the aperture of the antenna.

The maximum continuous power that can be applied is 250 W, and the maximum peak power is 8 kW. For example, to generate an electric field equal to 100 V/m at a distance of 3 meters at a frequency of 6.25 GHz, the calibration antenna factor read from Table 1 is 29.9 dB(m^{-1}). The gain in dB is computed using:

$$G(dB) = 20\,\log(F_{GHz}) - AF + 30.22$$

$$G(dB) = 20\,\log(6.25) - 29.9 + 30.22 = 16.2$$

The numeric gain is obtained as:

$$g = 10^{1.62} = 42.1$$

Applying this equation, we obtain:

$$P_t = \frac{|E|^2 \, R^2}{30\,g} = \frac{(100)^2\,(3)^2}{30\,(42.2)} = 71.1\,W$$

TABLE 1: MODEL 3160-01 POWER REQUIREMENTS AT 1 METER

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				100 V/m	200 V/m	500 V/m
0.96	14.6	28.8	15.3	11.58	46.31	289.41
1.00	14.9	31.1	15.3	10.72	42.90	268.10
1.05	15.3	34.0	15.3	9.79	39.17	244.81
1.10	15.7	37.1	15.3	8.99	35.94	224.64
1.15	16.0	40.2	15.4	8.28	33.13	207.06
1.20	16.4	43.5	15.4	7.67	30.66	191.64
1.25	16.7	46.8	15.4	7.12	28.49	178.04
1.30	17.0	50.2	15.5	6.64	26.56	165.99
1.35	17.3	53.7	15.5	6.21	24.84	155.27
1.40	17.6	57.2	15.5	5.83	23.31	145.68
1.45	17.8	60.8	15.6	5.48	21.93	137.09

TABLE 2: MODEL 3160-01 POWER REQUIREMENTS AT 3 AND 10 METERS

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	50 V/m	100 V/m	200 V/m	10 V/m	20 V/m	50 V/m
0.96	26.05	104.19	416.75	11.58	46.31	289.41
1.00	24.13	96.51	386.06	10.72	42.90	268.10
1.05	22.03	88.13	352.53	9.79	39.17	244.81
1.10	20.22	80.87	323.49	8.99	35.94	224.64
1.15	18.64	74.54	298.17	8.28	33.13	207.06
1.20	17.25	68.99	275.96	7.67	30.66	191.64
1.25	16.02	64.09	256.38	7.12	28.49	178.04
1.30	14.94	59.76	239.03	6.64	26.56	165.99
1.35	13.97	55.90	223.58	6.21	24.84	155.27
1.40	13.11	52.45	209.78	5.83	23.31	145.68
1.45	12.34	49.35	197.40	5.48	21.93	137.09

TABLE 3: MODEL 3160-02 POWER REQUIREMENTS AT 1 METER

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				100 V/m	200 V/m	500 V/m
1.12	14.5	28.0	16.7	11.91	47.62	297.63
1.15	14.7	29.4	16.7	11.33	45.31	283.18
1.20	15.0	31.9	16.7	10.46	41.84	261.48
1.25	15.4	34.4	16.8	9.69	38.77	242.34
1.30	15.7	37.0	16.8	9.01	36.06	225.37
1.35	16.0	39.6	16.8	8.41	33.64	210.26
1.40	16.3	42.4	16.9	7.87	31.48	196.74
1.45	16.5	45.1	16.9	7.38	29.54	184.61
1.50	16.8	48.0	16.9	6.95	27.79	173.68
1.55	17.1	50.9	16.9	6.55	26.21	163.79
1.60	17.3	53.8	17.0	6.19	24.77	154.83
1.65	17.5	56.8	17.0	5.87	23.47	146.67
1.70	17.8	59.9	17.0	5.57	22.28	139.23

TABLE 4: MODEL 3160-02 POWER REQUIREMENTS AT 3 AND 10 METERS

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	50 V/m	100 V/m	200 V/m	10 V/m	20 V/m	50 V/m
1.12	26.79	107.15	428.58	11.91	47.62	297.63
1.15	25.49	101.95	407.78	11.33	45.31	283.18
1.20	23.53	94.13	376.53	10.46	41.84	261.48
1.25	21.81	87.24	348.97	9.69	38.77	242.34
1.30	20.28	81.13	324.53	9.01	36.06	225.37
1.35	18.92	75.69	302.77	8.41	33.64	210.26
1.40	17.71	70.83	283.31	7.87	31.48	196.74
1.45	16.61	66.46	265.84	7.38	29.54	184.61
1.50	15.63	62.52	250.09	6.95	27.79	173.68
1.55	14.74	58.96	235.86	6.55	26.21	163.79
1.60	13.93	55.74	222.95	6.19	24.77	154.83
1.65	13.20	52.80	211.21	5.87	23.47	146.67
1.70	12.53	50.12	200.50	5.57	22.28	139.23

TABLE 5: MODEL 3160-03 POWER REQUIREMENTS AT 1 METER

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				100 V/m	200 V/m	500 V/m
1.70	14.4	27.4	20.4	12.17	48.69	304.31
1.75	14.6	28.9	20.4	11.52	46.10	288.10
1.80	14.8	30.5	20.5	10.93	43.72	273.23
1.85	15.1	32.1	20.5	10.38	41.53	259.54
1.90	15.3	33.7	20.5	9.88	39.51	246.93
1.95	15.5	35.4	20.5	9.41	37.64	235.28
2.00	15.7	37.1	20.5	8.98	35.92	224.50
2.05	15.9	38.9	20.5	8.58	34.32	214.49
2.10	16.1	40.6	20.6	8.21	32.83	205.20
2.15	16.3	42.4	20.6	7.86	31.45	196.55
2.20	16.5	44.2	20.6	7.54	30.16	188.48
2.25	16.6	46.1	20.6	7.24	28.95	180.96
2.30	16.8	47.9	20.6	6.96	27.83	173.91
2.35	17.0	49.8	20.6	6.69	26.77	167.32
2.40	17.1	51.7	20.7	6.45	25.78	161.14
2.45	17.3	53.6	20.7	6.21	24.85	155.34
2.50	17.5	55.6	20.7	6.00	23.98	149.88
2.55	17.6	57.6	20.7	5.79	23.16	144.74
2.60	17.7	59.6	20.7	5.60	22.38	139.90

TABLE 6: MODEL 3160-03 POWER REQUIREMENTS AT 3 AND 10 METERS

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	50 V/m	100 V/m	200 V/m	10 V/m	20 V/m	50 V/m
1.70	27.39	109.55	438.20	12.17	48.69	304.31
1.80	24.59	98.36	393.44	10.93	43.72	273.23
1.90	22.22	88.90	355.58	9.88	39.51	246.93
2.00	20.20	80.82	323.27	8.98	35.92	224.50
2.10	18.47	73.87	295.49	8.21	32.83	205.20
2.20	16.96	67.85	271.42	7.54	30.16	188.48
2.30	15.65	62.61	250.44	6.96	27.83	173.91
2.40	14.50	58.01	232.04	6.45	25.78	161.14
2.50	13.49	53.96	215.83	6.00	23.98	149.88
2.60	12.59	50.37	201.46	5.60	22.38	139.90

TABLE 7: MODEL 3160-04 POWER REQUIREMENTS AT 1 METER

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				100 V/m	200 V/m	500 V/m
2.60	14.8	30.5	23.7	10.95	43.78	273.64
2.70	15.2	32.8	23.7	10.18	40.70	254.39
2.80	15.5	35.1	23.7	9.49	37.95	237.18
2.90	15.8	37.6	23.7	8.87	35.47	221.71
3.00	16.0	40.1	23.7	8.31	33.24	207.77
3.10	16.3	42.7	23.7	7.81	31.22	195.15
3.20	16.6	45.4	23.7	7.35	29.39	183.70
3.30	16.8	48.1	23.7	6.93	27.72	173.28
3.40	17.1	50.9	23.8	6.55	26.20	163.77
3.50	17.3	53.7	23.8	6.20	24.81	155.06
3.60	17.5	56.7	23.8	5.88	23.53	147.06
3.70	17.8	59.6	23.8	5.59	22.35	139.71
3.80	18.0	62.7	23.8	5.32	21.27	132.94
3.90	18.2	65.8	23.8	5.07	20.27	126.68
3.95	18.3	67.4	23.8	4.95	19.80	123.72
3.80	18.0	62.7	23.8	5.32	21.27	132.94
3.90	18.2	65.8	23.8	5.07	20.27	126.68
3.95	18.3	67.4	23.8	4.95	19.80	123.72

TABLE 8: MODEL 3160-04 POWER REQUIREMENTS AT 3 AND 10 METERS

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	50 V/m	100 V/m	200 V/m	10 V/m	20 V/m	50 V/m
2.60	24.63	98.51	394.04	10.95	43.78	273.64
2.70	22.90	91.58	366.33	10.18	40.70	254.39
2.80	21.35	85.38	341.53	9.49	37.95	237.18
2.90	19.95	79.82	319.26	8.87	35.47	221.71
3.00	18.70	74.80	299.18	8.31	33.24	207.77
3.10	17.56	70.25	281.02	7.81	31.22	195.15
3.20	16.53	66.13	264.53	7.35	29.39	183.70
3.30	15.60	62.38	249.52	6.93	27.72	173.28
3.40	14.74	58.96	235.82	6.55	26.20	163.77
3.50	13.96	55.82	223.28	6.20	24.81	155.06
3.60	13.24	52.94	211.77	5.88	23.53	147.06
3.70	12.57	50.30	201.19	5.59	22.35	139.71
3.80	11.96	47.86	191.43	5.32	21.27	132.94
3.90	11.40	45.60	182.41	5.07	20.27	126.68
3.95	11.14	44.54	178.16	4.95	19.80	123.72

Table 9: Model 3160-05 Power Requirements at 1 Meter

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				100 V/m	200 V/m	500 V/m
3.95	14.92	31.08	27.21	10.73	42.91	268.16
4.00	15.03	31.84	27.21	10.47	41.88	261.72
4.10	15.24	33.39	27.22	9.98	39.93	249.56
4.20	15.44	34.98	27.23	9.53	38.12	238.25
4.30	15.63	36.59	27.24	9.11	36.44	227.72
4.40	15.83	38.24	27.24	8.72	34.86	217.90
4.50	16.01	39.92	27.25	8.35	33.40	208.73
4.60	16.19	41.63	27.26	8.01	32.02	200.15
4.70	16.37	43.38	27.27	7.68	30.74	192.12
4.80	16.55	45.15	27.28	7.38	29.53	184.58
4.90	16.72	46.95	27.29	7.10	28.40	177.50
5.00	16.88	48.78	27.30	6.83	27.34	170.84
5.10	17.04	50.64	27.31	6.58	26.33	164.57
5.20	17.20	52.52	27.32	6.35	25.39	158.66
5.30	17.36	54.44	27.33	6.12	24.49	153.08
5.40	17.51	56.38	27.34	5.91	23.65	147.81
5.50	17.66	58.34	27.35	5.71	22.85	142.83
5.60	17.81	60.34	27.36	5.52	22.10	138.11
5.70	17.95	62.36	27.37	5.35	21.38	133.64
5.80	18.09	64.40	27.38	5.18	20.70	129.39
5.85	18.16	65.43	27.39	5.09	20.38	127.35

Table 10: Model 3160-05 Power Requirements at 3 and 10 Meters

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	50 V/m	100 V/m	150 V/m	10 V/m	20 V/m	50 V/m
3.95	24.13	96.54	217.21	10.73	42.91	268.16
4.00	23.56	94.22	212.00	10.47	41.88	261.72
4.50	18.79	75.14	169.07	8.35	33.40	208.73
5.00	15.38	61.50	138.38	6.83	27.34	170.84
5.50	12.85	51.42	115.69	5.71	22.85	142.83
5.85	11.46	45.85	103.16	5.09	20.38	127.35

TABLE 11: MODEL 3160-06 POWER REQUIREMENTS AT 1 METER

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				100 V/m	200 V/m	500 V/m
5.85	15.7	37.1	29.8	8.98	35.91	224.43
5.90	15.8	37.7	29.8	8.83	35.33	220.79
5.95	15.8	38.4	29.9	8.69	34.76	217.24
6.00	15.9	39.0	29.9	8.55	34.21	213.79
6.25	16.2	42.1	29.9	7.91	31.64	197.73
6.50	16.6	45.4	29.9	7.34	29.36	183.49
6.75	16.9	48.8	29.9	6.83	27.33	170.81
7.00	17.2	52.3	29.9	6.38	25.51	159.46
7.25	17.5	55.8	29.9	5.97	23.88	149.27
7.50	17.7	59.5	30.0	5.60	22.41	140.08
7.75	18.0	63.2	30.0	5.27	21.08	131.77
8.00	18.3	67.1	30.0	4.97	19.88	124.23
8.20	18.5	70.2	30.0	4.75	18.99	118.69

TABLE 12: MODEL 3160-06 POWER REQUIREMENTS AT 3 AND 10 METERS

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	50 V/m	100 V/m	150 V/m	10 V/m	20 V/m	50 V/m
5.85	20.20	80.79	181.79	8.98	35.91	224.43
5.90	19.87	79.48	178.84	8.83	35.33	220.79
5.95	19.55	78.21	175.97	8.69	34.76	217.24
6.00	19.24	76.96	173.17	8.55	34.21	213.79
6.25	17.80	71.18	160.16	7.91	31.64	197.73
6.50	16.51	66.06	148.63	7.34	29.36	183.49
6.75	15.37	61.49	138.35	6.83	27.33	170.81
7.00	14.35	57.41	129.16	6.38	25.51	159.46
7.25	13.43	53.74	120.91	5.97	23.88	149.27
7.50	12.61	50.43	113.47	5.60	22.41	140.08
7.75	11.86	47.44	106.73	5.27	21.08	131.77
8.00	11.18	44.72	100.63	4.97	19.88	124.23
8.20	10.68	42.73	96.14	4.75	18.99	118.69

TABLE 13: MODEL 3160-07 POWER REQUIREMENTS AT 1 METER

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				100 V/m	200 V/m	500 V/m
8.20	15.1	32.3	33.4	10.33	41.31	258.20
8.25	15.1	32.7	33.4	10.21	40.83	255.20
8.50	15.4	34.6	33.4	9.64	38.56	240.98
8.75	15.6	36.6	33.4	9.12	36.48	227.97
9.00	15.9	38.6	33.4	8.64	34.57	216.03
9.25	16.1	40.6	33.4	8.20	32.81	205.05
9.50	16.3	42.8	33.4	7.80	31.19	194.92
9.75	16.5	44.9	33.5	7.42	29.69	185.57
10.00	16.7	47.1	33.5	7.08	28.30	176.90
10.25	16.9	49.3	33.5	6.75	27.02	168.87
10.50	17.1	51.6	33.5	6.46	25.82	161.40
10.75	17.3	54.0	33.5	6.18	24.71	154.45
11.00	17.5	56.3	33.5	5.92	23.68	147.97
11.25	17.7	58.7	33.5	5.68	22.71	141.92
11.50	17.9	61.2	33.5	5.45	21.80	136.26
11.75	18.0	63.6	33.6	5.24	20.95	130.96
12.00	18.2	66.1	33.6	5.04	20.16	125.99
12.40	18.5	70.2	33.6	4.75	18.98	118.65

TABLE 14: MODEL 3160-07 POWER REQUIREMENTS AT 3 AND 10 METERS

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	50 V/m	100 V/m	150 V/m	10 V/m	20 V/m	50 V/m
8.20	23.24	92.95	209.14	10.33	41.31	258.20
8.50	21.69	86.75	195.20	9.64	38.56	240.98
9.00	19.44	77.77	174.99	8.64	34.57	216.03
9.50	17.54	70.17	157.89	7.80	31.19	194.92
10.00	15.92	63.69	143.29	7.08	28.30	176.90
10.50	14.53	58.11	130.74	6.46	25.82	161.40
11.00	13.32	53.27	119.86	5.92	23.68	147.97
11.50	12.26	49.05	110.37	5.45	21.80	136.26
12.00	11.34	45.36	102.05	5.04	20.16	125.99
12.40	10.68	42.72	96.11	4.75	18.98	118.65

Table 15: Model 3160-08 Power Requirements at 1 Meter

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				100 V/m	200 V/m	400 V/m
12.4	15.0	31.9	37.0	10.44	41.78	167.12
12.5	15.1	32.4	37.0	10.29	41.15	164.59
13.0	15.4	34.9	37.1	9.55	38.21	152.82
13.5	15.7	37.5	37.1	8.90	35.58	142.34
14.0	16.0	40.1	37.1	8.31	33.24	132.96
14.5	16.3	42.8	37.1	7.78	31.14	124.54
15.0	16.6	45.6	37.1	7.31	29.24	116.95
15.5	16.9	48.4	37.2	6.88	27.52	110.08
16.0	17.1	51.4	37.2	6.49	25.96	103.85
16.5	17.3	54.3	37.2	6.14	24.55	98.19
17.0	17.6	57.3	37.2	5.81	23.25	93.01
17.5	17.8	60.4	37.2	5.52	22.07	88.28
18.0	18.0	63.5	37.3	5.25	20.98	83.94

Table 16: Model 3160-08 Power Requirements at 3 and 10 Meters

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	50 V/m	100 V/m	150 V/m	10 V/m	20 V/m	40 V/m
12.4	23.50	94.00	211.51	10.44	41.78	167.12
12.5	23.15	92.58	208.31	10.29	41.15	164.59
13.0	21.49	85.96	193.42	9.55	38.21	152.82
13.5	20.02	80.07	180.15	8.90	35.58	142.34
14.0	18.70	74.79	168.28	8.31	33.24	132.96
14.5	17.51	70.05	157.62	7.78	31.14	124.54
15.0	16.45	65.78	148.01	7.31	29.24	116.95
15.5	15.48	61.92	139.33	6.88	27.52	110.08
16.0	14.60	58.42	131.44	6.49	25.96	103.85
16.5	13.81	55.23	124.27	6.14	24.55	98.19
17.0	13.08	52.32	117.72	5.81	23.25	93.01
17.5	12.41	49.66	111.73	5.52	22.07	88.28
18.0	11.80	47.21	106.23	5.25	20.98	83.94

TABLE 17: MODEL 3160-09 POWER REQUIREMENTS AT 1 METER

Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m		
				10 V/m	100 V/m	200 V/m
18.0	15.1	32.4	40.2	0.10	10.30	41.19
18.5	15.3	34.1	40.2	0.10	9.78	39.13
19.0	15.5	35.8	40.2	0.09	9.31	37.23
19.5	15.8	37.6	40.3	0.09	8.87	35.47
20.0	16.0	39.4	40.3	0.08	8.46	33.85
20.5	16.2	41.2	40.3	0.08	8.08	32.34
21.0	16.3	43.1	40.3	0.08	7.73	30.94
21.5	16.5	45.0	40.3	0.07	7.41	29.63
22.0	16.7	46.9	40.3	0.07	7.10	28.42
22.5	16.9	48.9	40.4	0.07	6.82	27.28
23.0	17.1	50.9	40.4	0.07	6.56	26.22
23.5	17.2	52.9	40.4	0.06	6.31	25.23
24.0	17.4	54.9	40.4	0.06	6.07	24.29
24.5	17.6	56.9	40.4	0.06	5.85	23.42
25.0	17.7	59.0	40.4	0.06	5.65	22.60
25.5	17.9	61.1	40.5	0.05	5.46	21.82
26.0	18.0	63.2	40.5	0.05	5.27	21.09
26.5	18.2	65.3	40.5	0.05	5.10	20.40

TABLE 18: MODEL 3160-09 POWER REQUIREMENTS AT 3 AND 10 METERS

Frequency GHz	Field Strength @ 3 meters			Field Strength @ 10 meters		
	1 V/m	10 V/m	75 V/m	1 V/m	10 V/m	20 V/m
18.0	0.01	0.93	52.14	0.10	10.30	41.19
19.0	0.01	0.84	47.12	0.09	9.31	37.23
20.0	0.01	0.76	42.84	0.08	8.46	33.85
21.0	0.01	0.70	39.16	0.08	7.73	30.94
22.0	0.01	0.64	35.97	0.07	7.10	28.42
23.0	0.01	0.59	33.19	0.07	6.56	26.22
24.0	0.01	0.55	30.75	0.06	6.07	24.29
25.0	0.01	0.51	28.60	0.06	5.65	22.60
26.0	0.00	0.47	26.70	0.05	5.27	21.09
26.5	0.00	0.46	25.82	0.05	5.10	20.40

TABLE 19: MODEL 3160-10 POWER REQUIREMENTS AT 1 METER

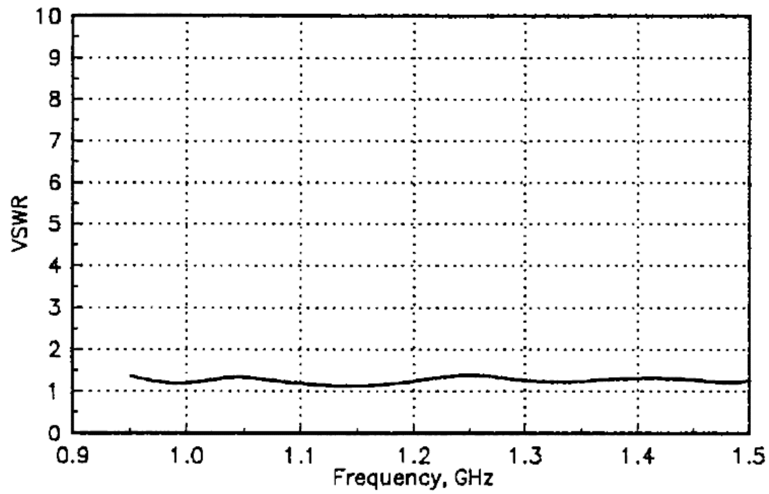
Frequency GHz	Gain dB	Gain Num.	AF dB(1/m)	Field Strength @ 1 m 10 V/m	50 V/m	100 V/m
26.50	15.28	33.70	43.39	0.10	2.47	9.89
27.00	15.43	34.89	43.40	0.10	2.39	9.55
28.00	15.72	37.32	43.42	0.09	2.23	8.93
29.00	16.00	39.82	43.45	0.08	2.09	8.37
30.00	16.27	42.37	43.47	0.08	1.97	7.87
31.00	16.53	44.97	43.50	0.07	1.85	7.41
32.00	16.78	47.63	43.52	0.07	1.75	7.00
33.00	17.02	50.34	43.55	0.07	1.66	6.62
34.00	17.25	53.09	43.58	0.06	1.57	6.28
35.00	17.47	55.88	43.61	0.06	1.49	5.97
36.00	17.69	58.72	43.64	0.06	1.42	5.68
37.00	17.89	61.59	43.67	0.05	1.35	5.41
38.00	18.09	64.49	43.70	0.05	1.29	5.17
39.00	18.29	67.43	43.73	0.05	1.24	4.94
40.00	18.47	70.39	43.77	0.05	1.18	4.74

TABLE 20: MODEL 3160-10 POWER REQUIREMENTS AT 3 AND 10 METERS

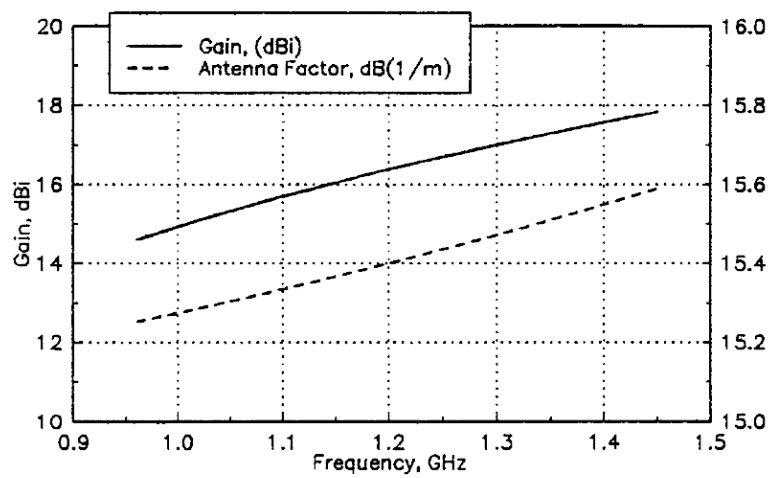
Frequency	Field Strength @ 3 meters			Field Strength @ 10 meters		
GHz	1 V/m	10 V/m	30 V/m	1 V/m	5 V/m	10 V/m
26.50	0.01	0.89	8.01	0.10	2.47	9.89
27.00	0.01	0.86	7.74	0.10	2.39	9.55
28.00	0.01	0.80	7.23	0.09	2.23	8.93
29.00	0.01	0.75	6.78	0.08	2.09	8.37
30.00	0.01	0.71	6.37	0.08	1.97	7.87
31.00	0.01	0.67	6.00	0.07	1.85	7.41
32.00	0.01	0.63	5.67	0.07	1.75	7.00
33.00	0.01	0.60	5.36	0.07	1.66	6.62
34.00	0.01	0.57	5.09	0.06	1.57	6.28
35.00	0.01	0.54	4.83	0.06	1.49	5.97
36.00	0.01	0.51	4.60	0.06	1.42	5.68
37.00	0.00	0.49	4.38	0.05	1.35	5.41
38.00	0.00	0.47	4.19	0.05	1.29	5.17
39.00	0.00	0.44	4.00	0.05	1.24	4.94
40.00	0.00	0.43	3.84	0.05	1.18	4.74

3160-01

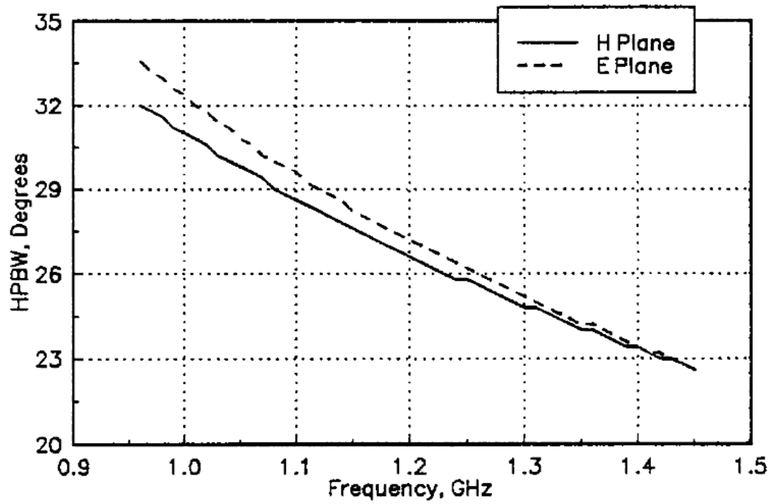
VSWR: 3160-01



GAIN / ANTENNA FACTOR: 3160-01

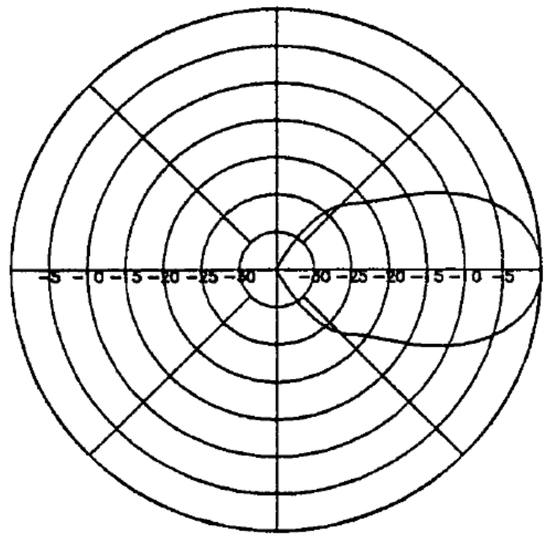


HALF-POWER BEAMWIDTH: 3160-01

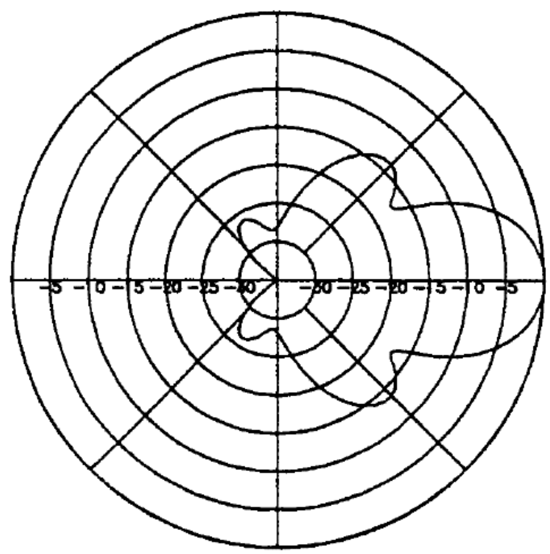


ANTENNA PATTERN: 3160-01 AT 1.2 GHZ

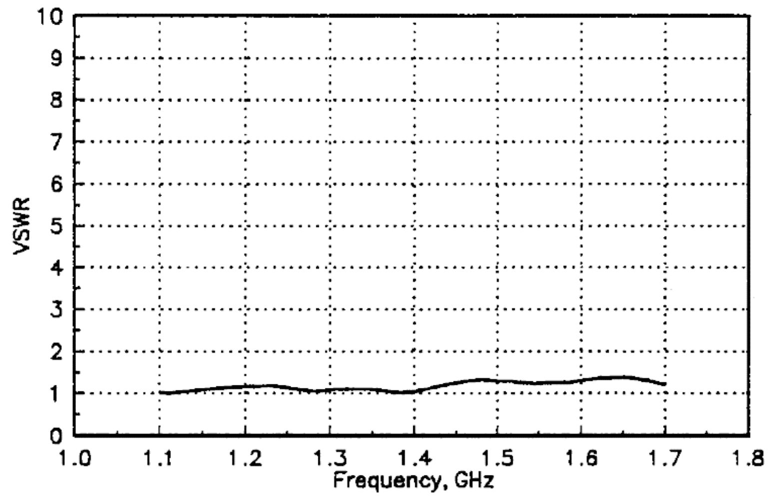
H-PLANE: 3160-01



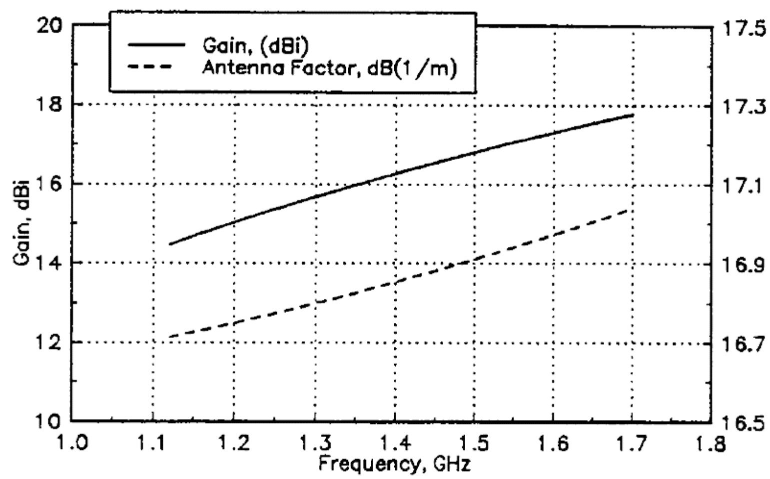
E-PLANE: 3160-01



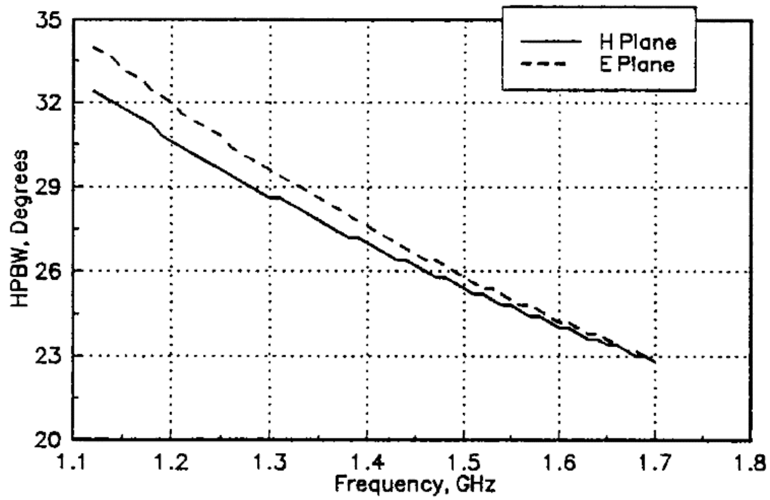
VSWR: 3160-02



GAIN / ANTENNA FACTOR: 3160-02

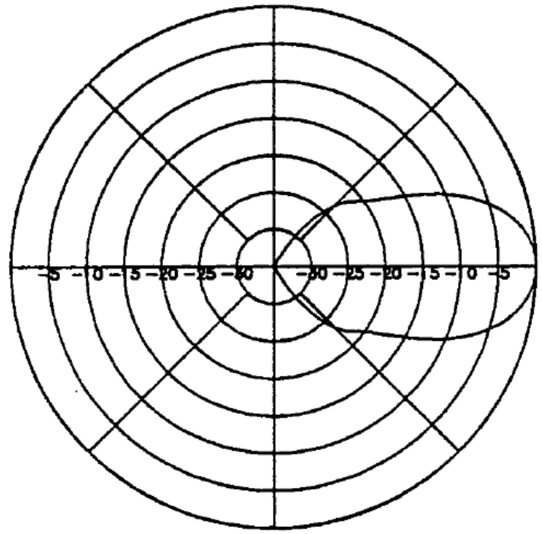


HALF-POWER BEAMWIDTH: 3160-02

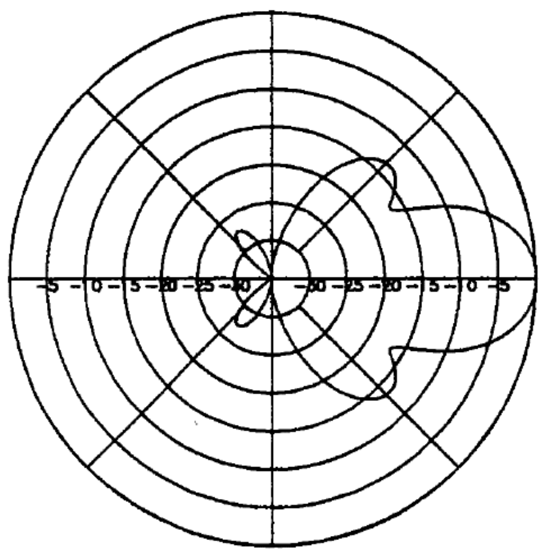


Antenna Pattern: 3160-02 at 1.41 GHz

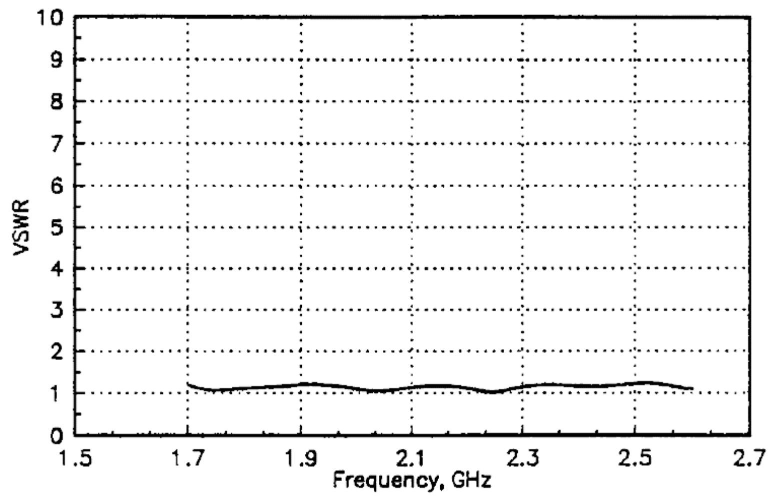
H-PLANE: 3160-02



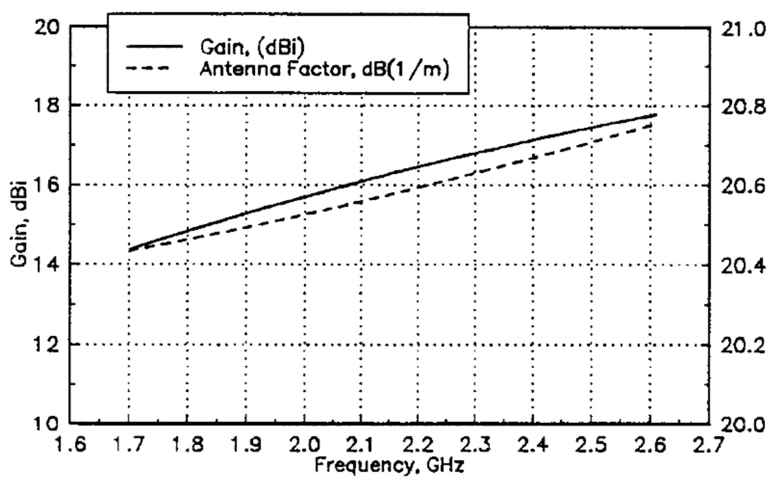
E-PLANE: 3160-02



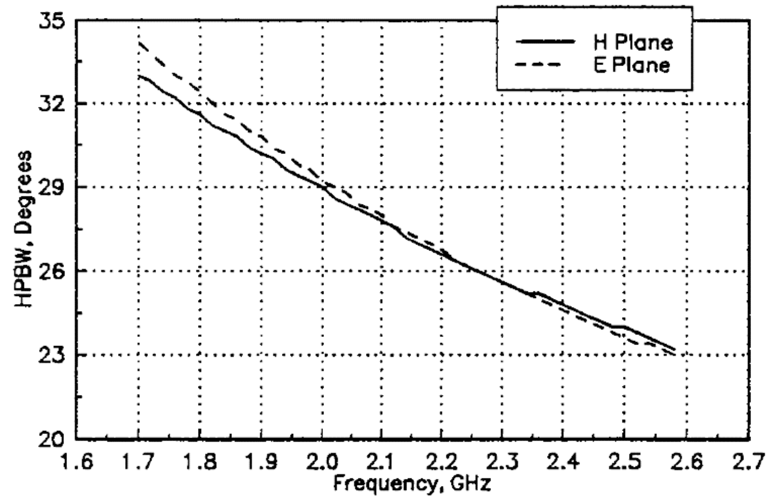
VSWR: 3160-03



Gain / Antenna Factor: 3160-03

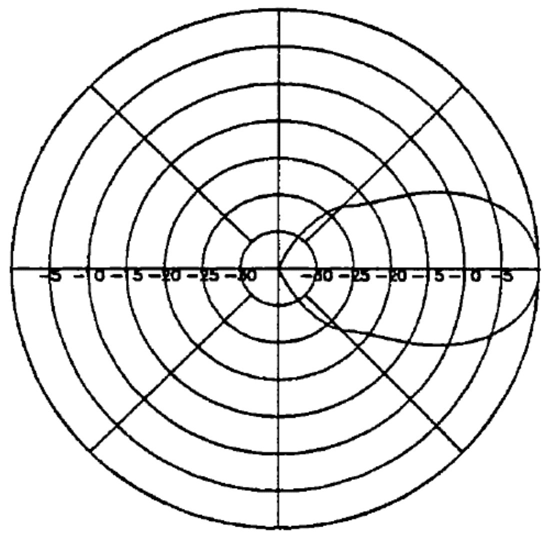


HALF-POWER BEAMWIDTH: 3160-03

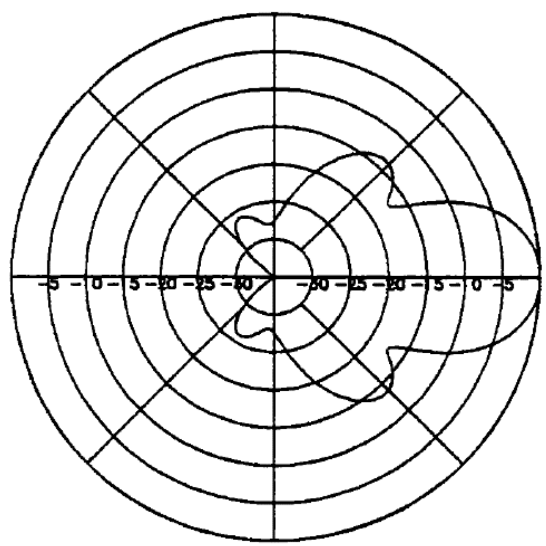


ANTENNA PATTERN: 3160-03 AT 2.15 GHZ

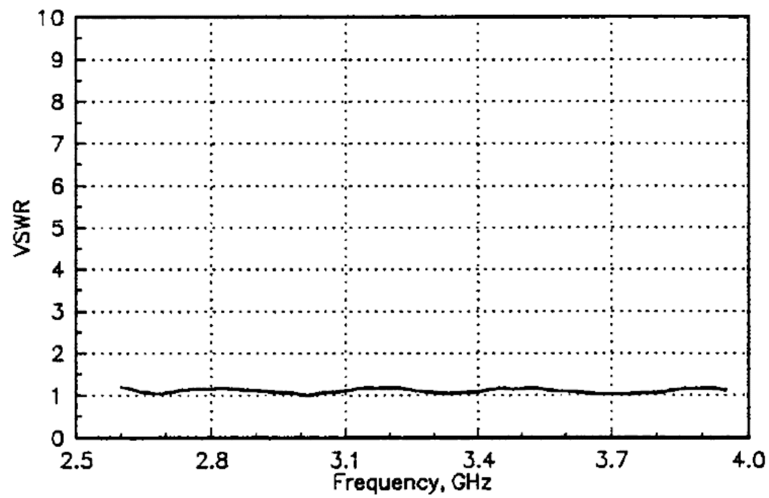
H-PLANE: 3160-03



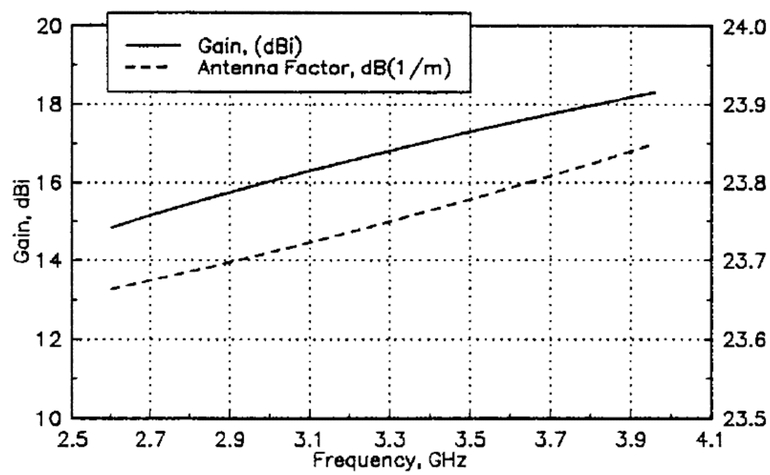
E-PLANE: 3160-03



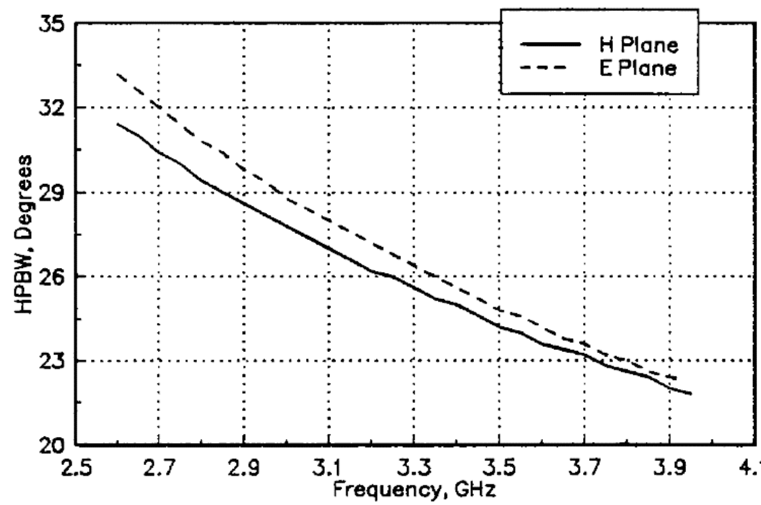
VSWR: 3160-04



GAIN / ANTENNA FACTOR: 3160-04

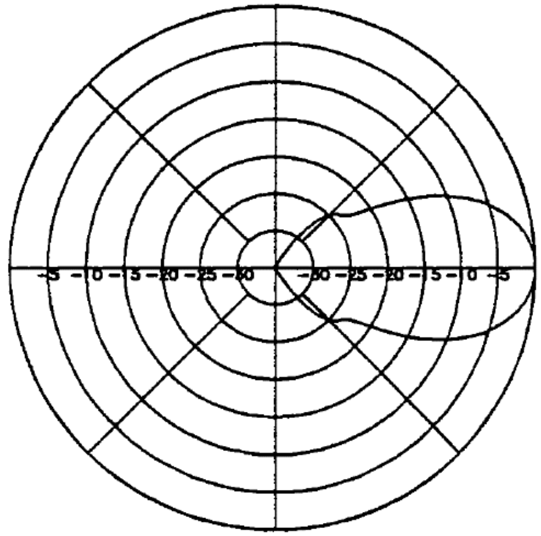


HALF-POWER BEAMWIDTH: 3160-04

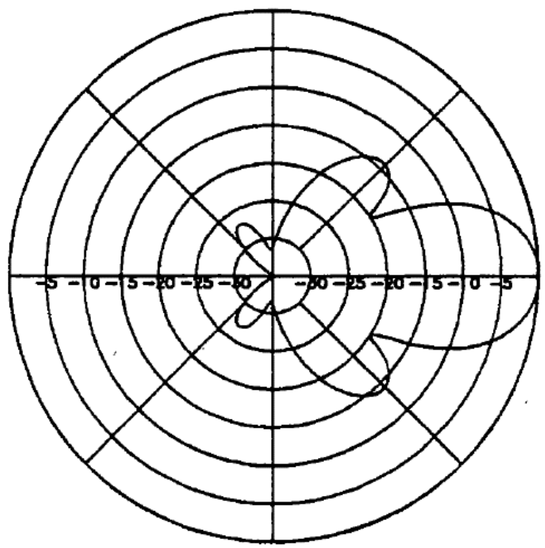


ANTENNA PATTERN: 3160-04 AT 3.3 GHZ

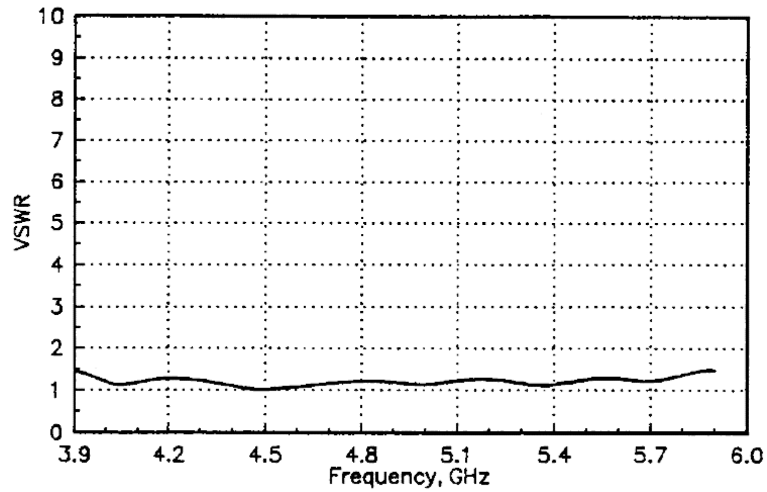
H-PLANE: 3160-04



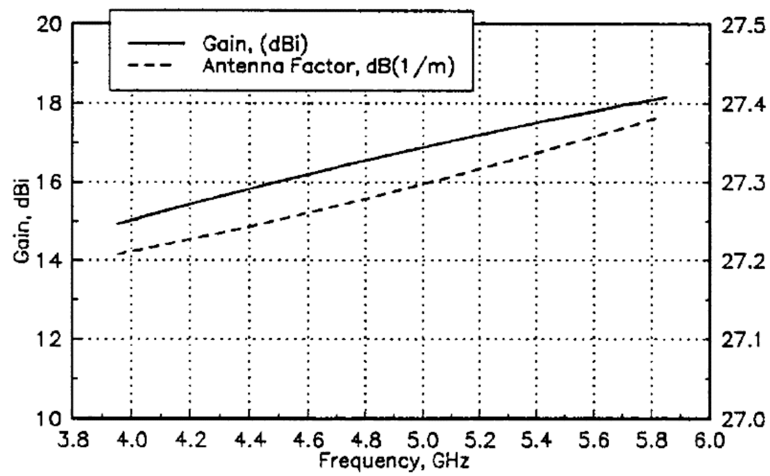
E-PLANE: 3160-04



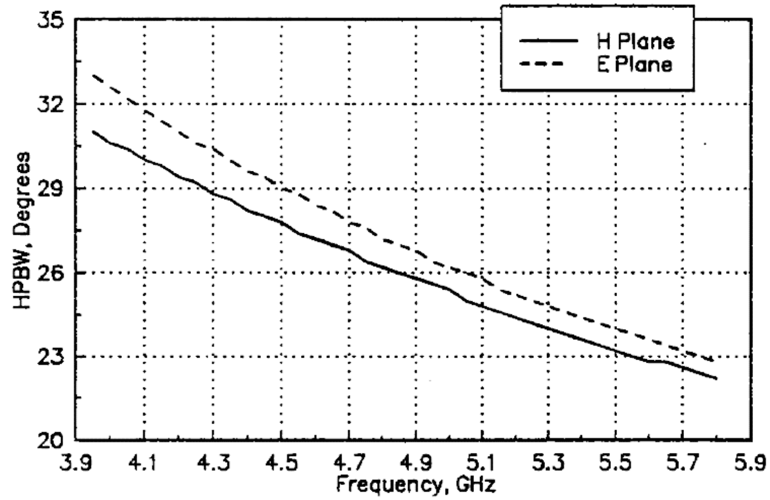
VSWR: 3160-05



GAIN / ANTENNA FACTOR: 3160-05

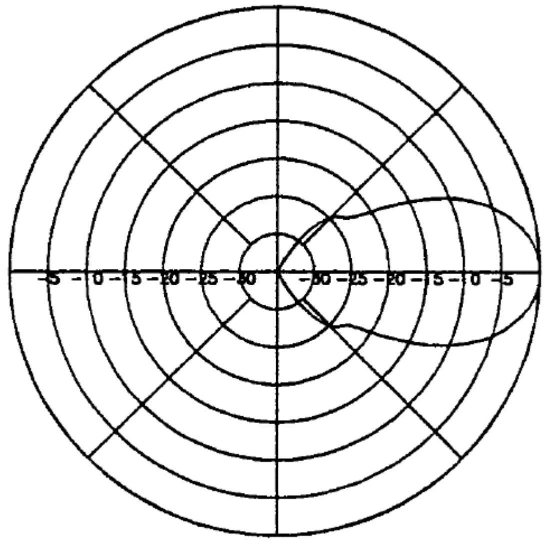


HALF-POWER BEAMWIDTH: 3160-05

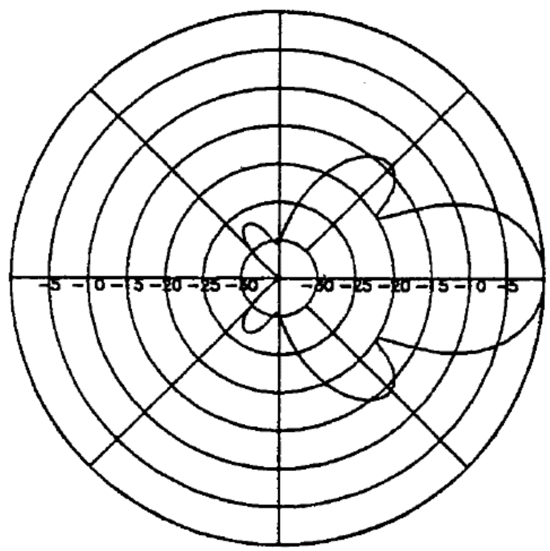


Antenna Pattern: 3160-05 at 4.9 GHz

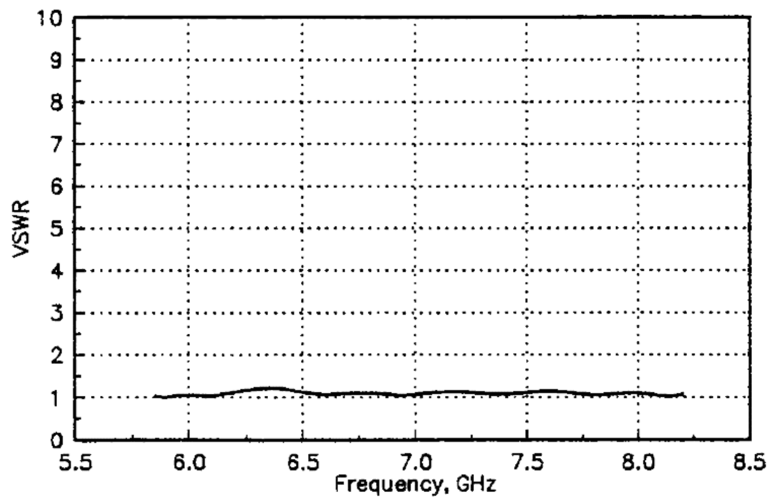
H-PLANE: 3160-05



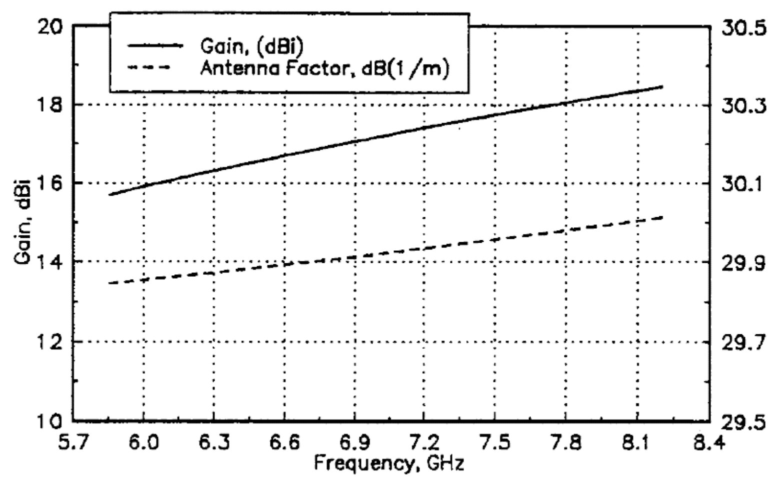
E-PLANE: 3160-05



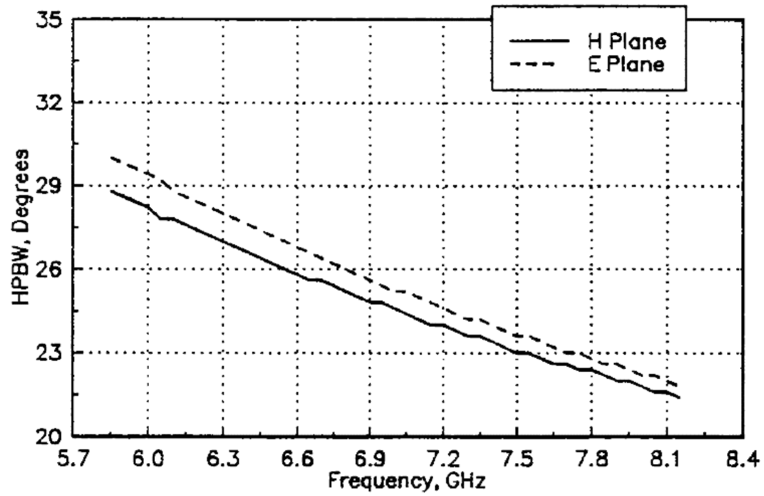
VSWR: 3160-06



GAIN / ANTENNA FACTOR: 3160-06

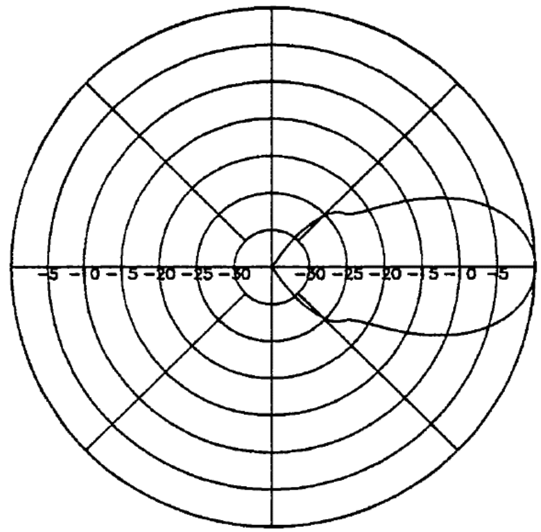


HALF-POWER BEAMWIDTH: 3160-06

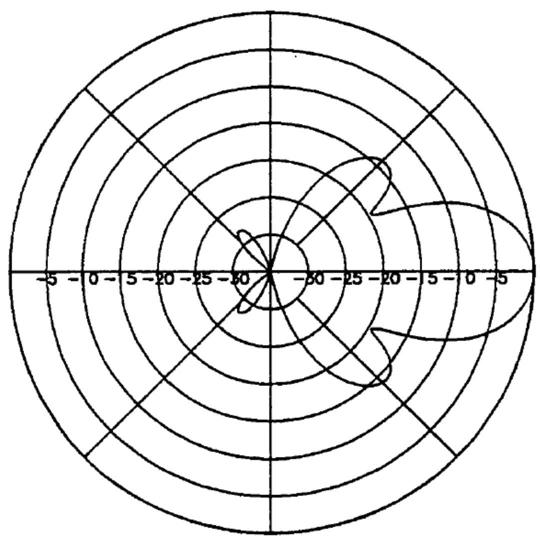


ANTENNA PATTERN: 3160-06 AT 7.0 GHZ

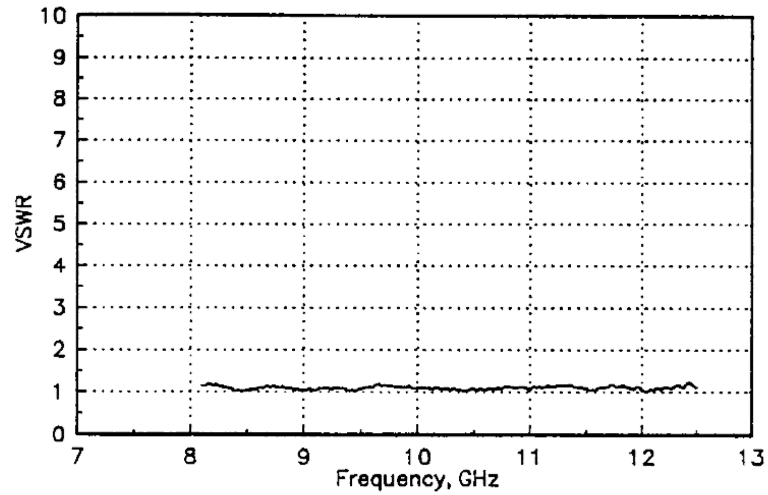
H-PLANE: 3160-06



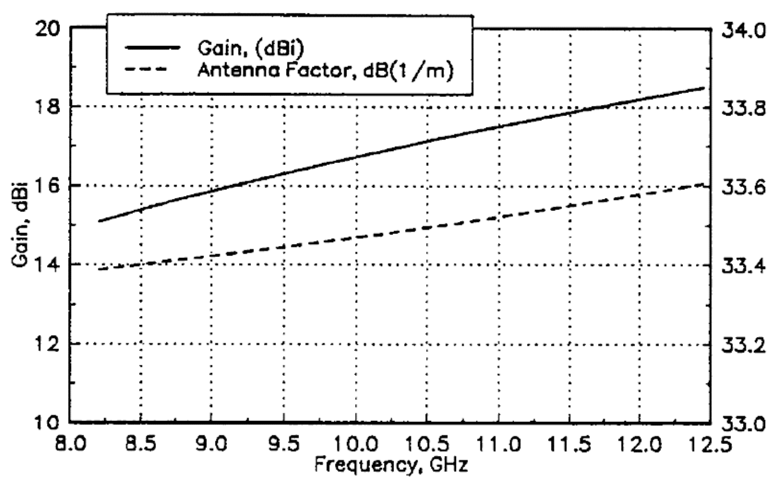
E-PLANE: 3160-06



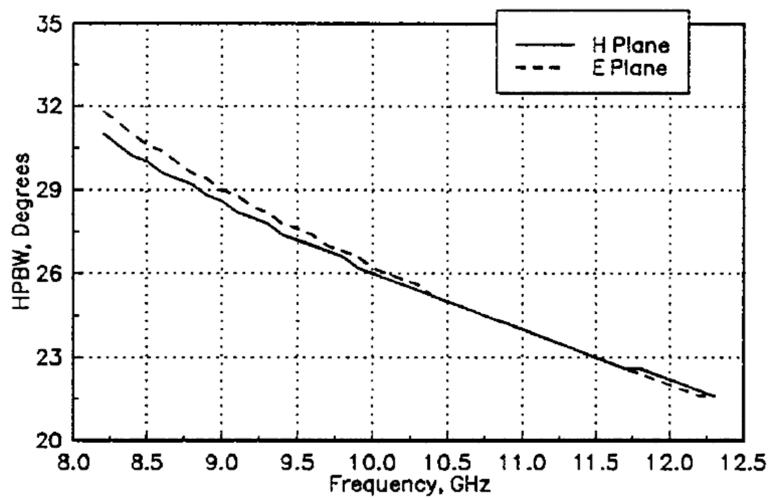
VSWR: 3160-07



GAIN / ANTENNA FACTOR: 3160-07

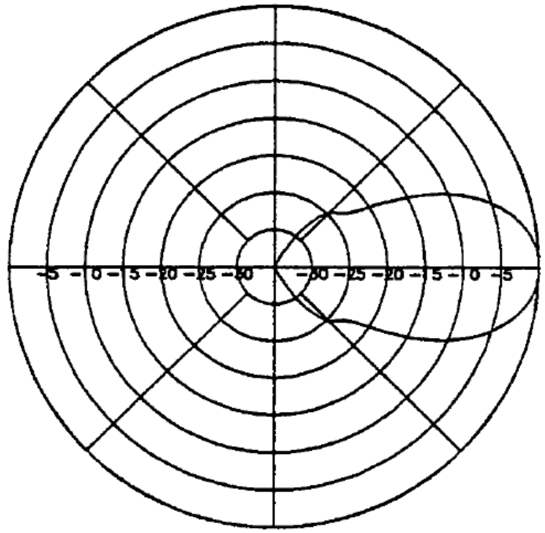


HALF-POWER BEAMWIDTH: 3160-07

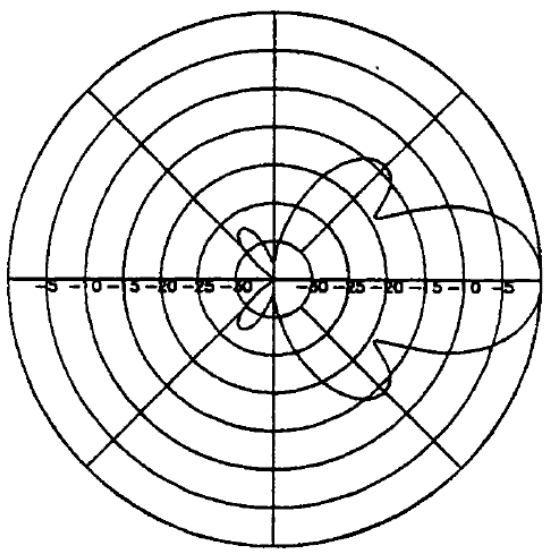


ANTENNA PATTERN: 3160-07 AT 10.3 GHZ

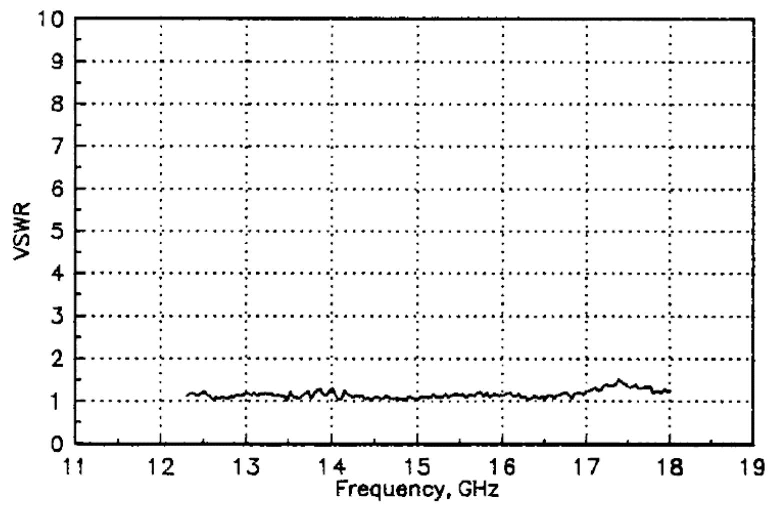
H-PLANE: 3160-07



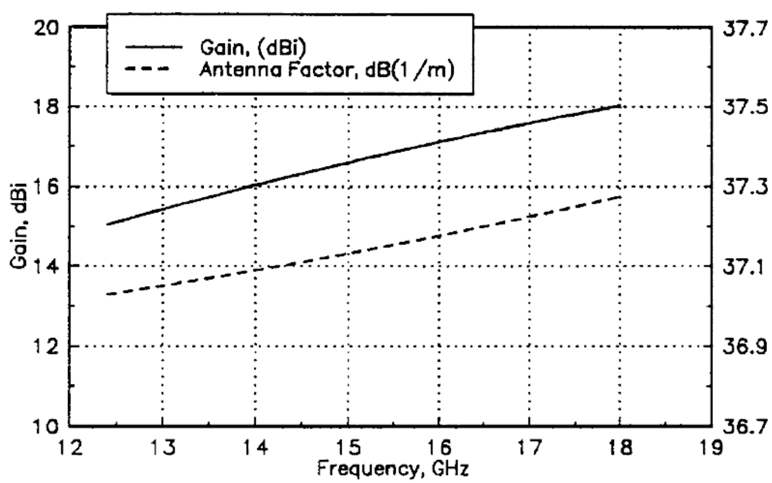
E-PLANE: 3160-07



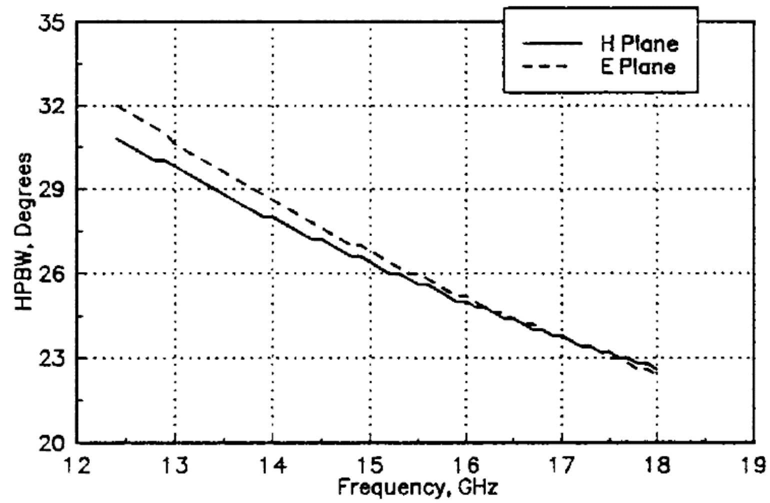
VSWR: 3160-08



GAIN / ANTENNA FACTOR: 3160-08

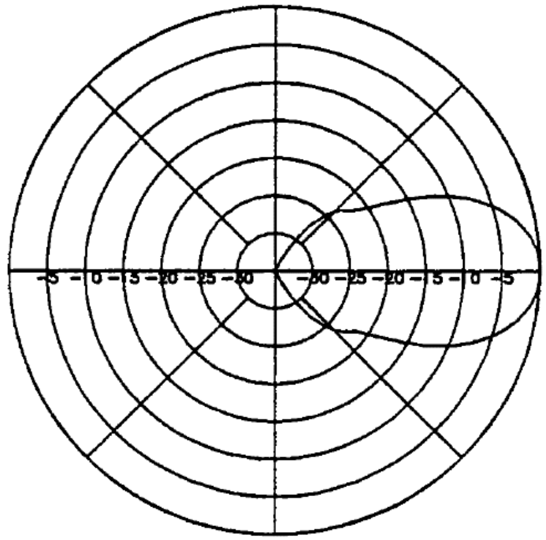


HALF-POWER BEAMWIDTH: 3160-08

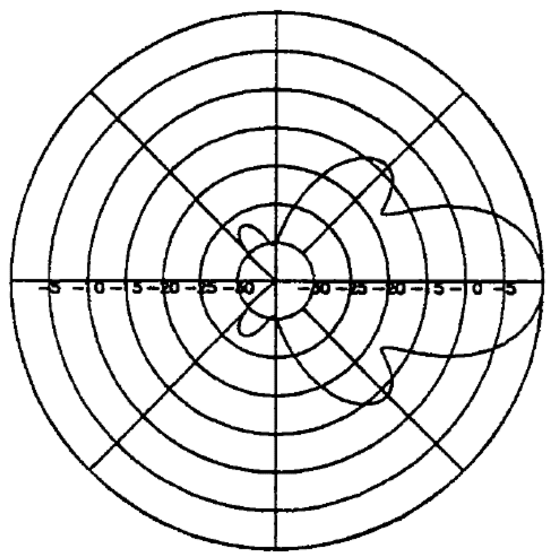


ANTENNA PATTERN: 3160-08 AT 15.2 GHZ

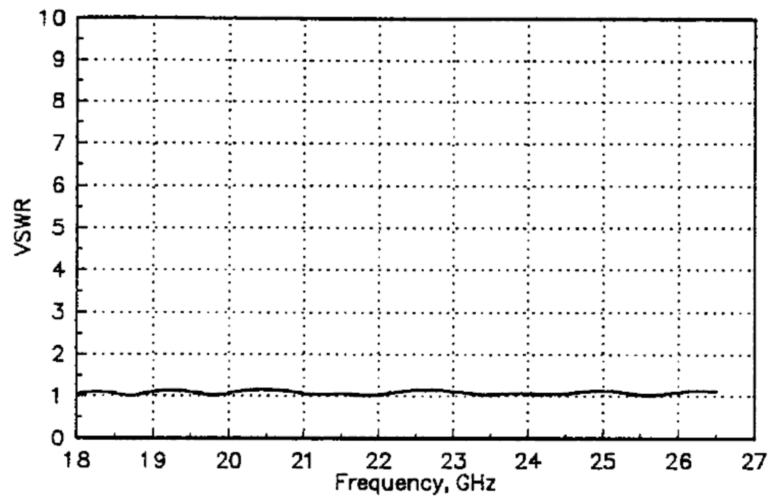
H-PLANE: 3160-08



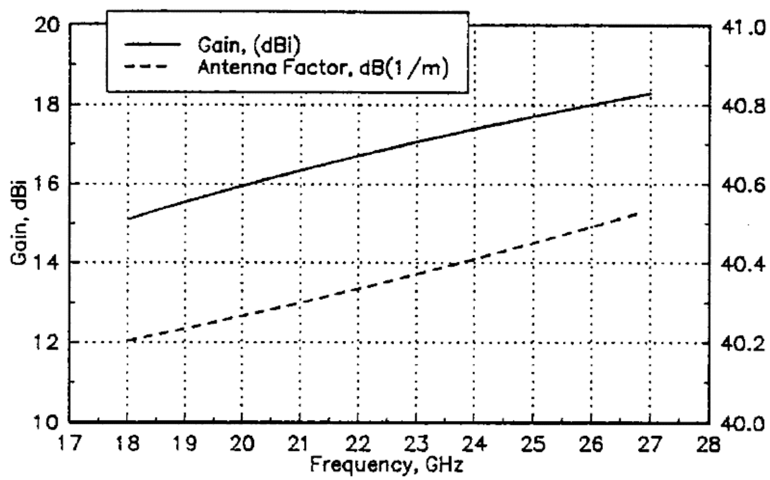
E-PLANE: 3160-08



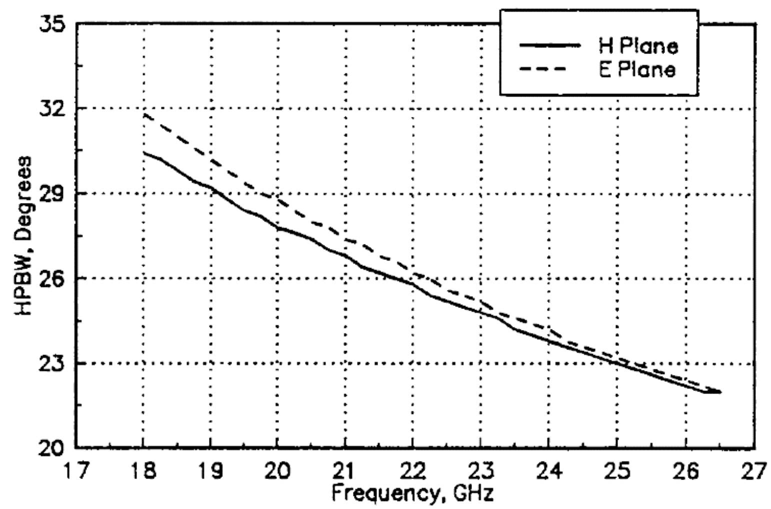
VSWR: 3160-09



GAIN / ANTENNA FACTOR: 3160-09

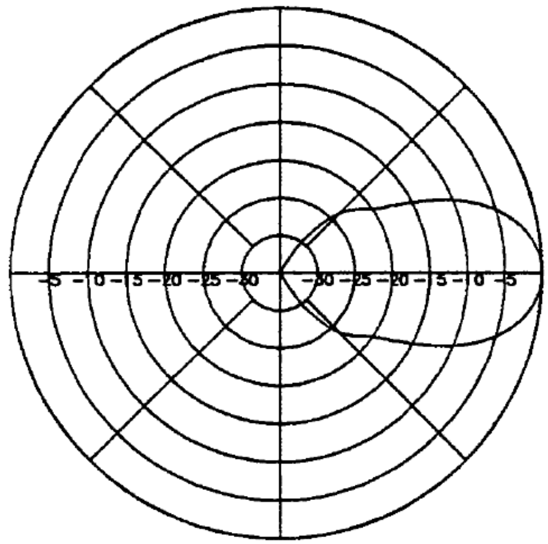


HALF-POWER BEAMWIDTH: 3160-09

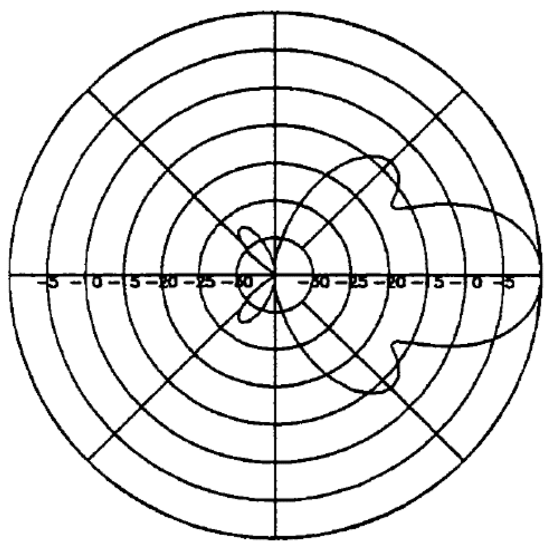


ANTENNA PATTERN: 3160-09 AT 22.0 GHZ

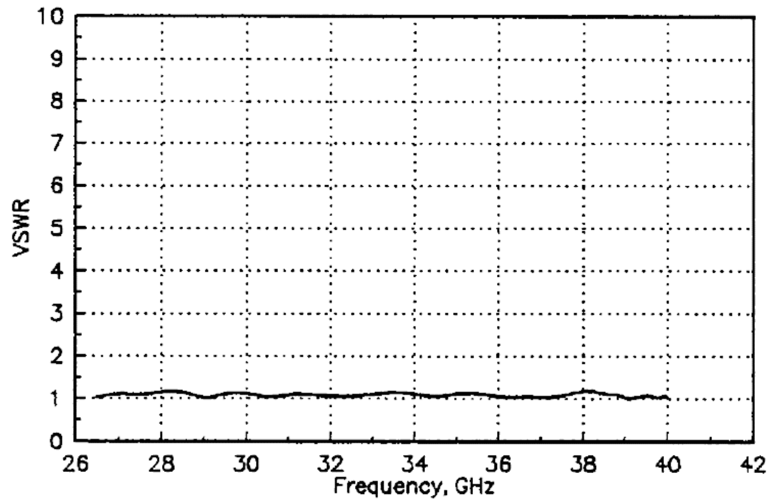
H-PLANE: 3160-09



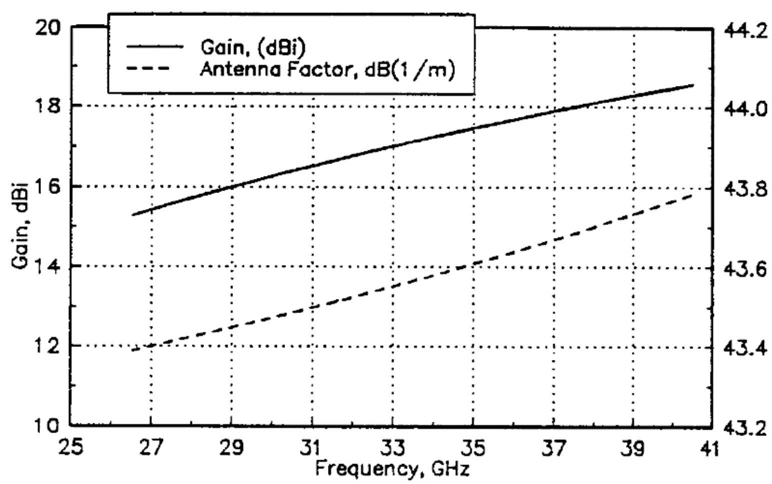
E-PLANE: 3160-09



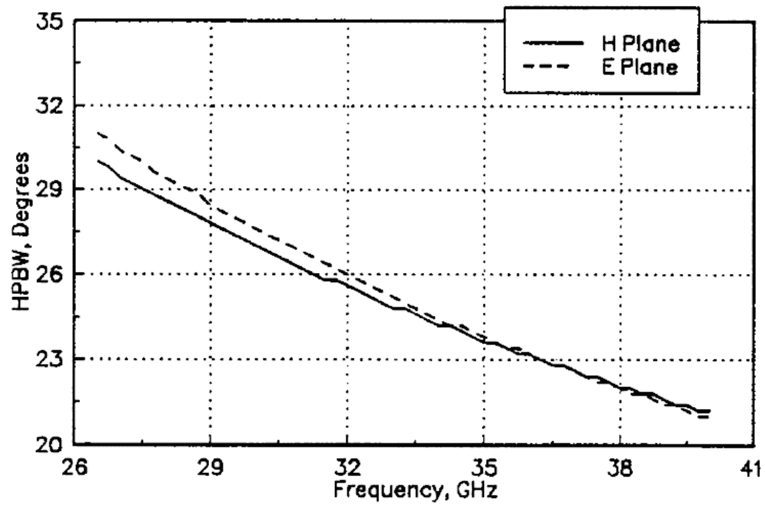
VSWR: 3160-10



GAIN / ANTENNA FACTOR: 3160-10

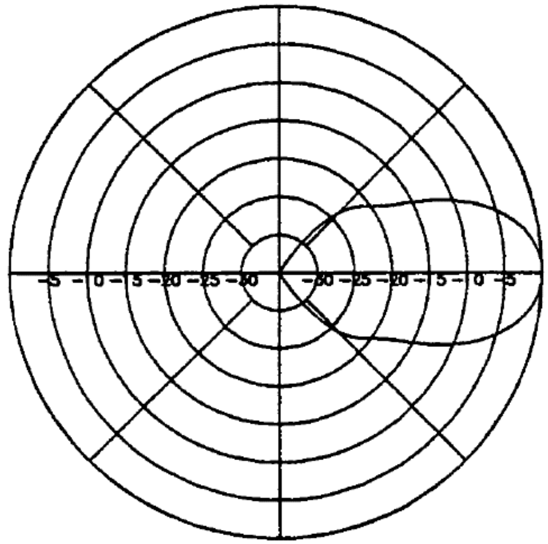


HALF-POWER BEAMWIDTH: 3160-10



ANTENNA PATTERN: 3160-10 AT 33.0 GHZ

H-PLANE: 3160-10



E-PLANE: 3160-10

